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THE PICKERING MESONET 1988 DATA REPORT

by

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ABSTRACT

This report describes the demonstration mesoscale meteorological monitoring network ("mesonet") installed in the vicinity of the Pickering Nuiclear Generating Station. It also summarizes the data collected by the network during 1988 and provides some examples of situations in which mesosclae effects dominate the local wind flow.

RÉSUMÉ

Le présent rapport décrit le réseau de contrôle météorologique d'échelle moyenne de démonstration («mesonet») installé près de la centrale nucléaire Pickering. Il résume aussi les données recueillies par le réseau en 1988 et fournit quelques exemples de situations où les effets d'échelle moyenne dominent la coulée de vent local.

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1 INTRODUCTION

1.1 History

In February 1987, AES held a small workshop on Environmental Emergency Response at which one of the authors presented a paper (see Appendix D) on 'Surface Weather Data Acquisition Near Potential Accident Locations'. The paper briefly described the surface mesonet stations that we had developed for deployment in the Canadian Atlantic Storms Program (CASP) field project in 1986, and proposed that similar stations could form a basis for relatively inexpensive and reliable networks of surface meteorological stations around nuclear power plants and other sites where there could be a potential for the release of toxic or hazardous materials to the atmosphere. Ms. Lily Truong of AECB noted our presentation and approached AES to obtain further details. This eventually led to the establishment of a 6 month demonstration project to deploy one 'primary' station, with a 10m weather station and a 26m profile tower, and 8 'secondary' 10m weather stations in the vicinity of the Pickering Nuclear Generating Station. The stations were deployed and tested in December 1987 and data collection formally began on January 1, 1988. Other parties, in particular the Ontario Ministries of the Solicitor General and of the Environment, took a keen interest in the project and in the data being collected. As a result, an extension for the full 12 months of 1988 was soon requested and agreed to by AES. The present report deals with measurements made over that period. In fact, the network is still in place and a tentative agreement has recently been reached between the parties named above and Ontario Hydro to extend the operation for the 1989 calendar year in order to compile a more complete climatology.

1.2 The Purpose of the Pickering Mesonet

From the AES viewpoint, the initial concept of the project, formally designated as the 'Meteorological Monitoring Network for Pickering Nuclear Generating Station', was as a demonstration to AECB and others that networks of surface stations could be deployed around Nuclear Generating Stations at relatively low cost and could provide both site-specific, climatological data for safety analyses and, potentially, on-line, real-time data for use in environmental emergency situations. Real-time access to the data was not in fact implemented in 1988 but is now available, via telephone, at the primary station (Cherrywood). The 1986 AECB 'Staff Position on Adequate Meteorological Monitoring Standards for Safety Analyses of Nuclear Facilities', Truong (1986), recommends the installation of a Primary Tower, in a location which is expected to be representative of the region into which any airborne materials will be released, and, for facilities located in coastal areas or in other complex terrain,

Secondary Towers to resolve any mesoscale variations in meteorological fields and dispersion characteristics. Data from the primary tower provide basic information on wind speed and temperature profiles for the determination of atmospheric stability and dispersion characteristics while the secondary tower data allow us to investigate conditions under which there are substantial spatial variations in the wind and dispersion fields. These include lake breeze situations, calm, clear nights with some drainage flow towards the lake, frontal passages and other occasions involving non-steady meteorological phenomena.

To summarize, we might say that the project started as a short-term demonstration, but has evolved into a slightly longer-term monitoring operation to provide a full test of the ability of the type of network deployed to deliver the surface weather data.

2 METEOROLOGICAL MEASUREMENTS

2.1 Introduction

The Pickering Mesonet consists of a network of 8 (9 originally) instrumented 10m posts (PAQMOS-10m's) and one instrumented 26m tower (PAQMOS-26m). A full description of the standard PAQMOS-10m and the surface meteorological measurements that can be made with it is contained in Appendix A. The PAQMOS-26m and its instrumentation are described in detail in Appendix B. The acronym PAQMOS stands for Portable Air Quality and Meteorological Observing System.

The measurements made with the PAQMOS-10m's and the PAQMOS-26m are summarized in Tables 1 to 4. The PAQMOS-10m deployment was designed to demonstrate the spatial variability of wind speed, direction, temperature, humidity and, to a lesser extent, barometric pressure in the region surrounding the Pickering Nuclear Generating Station (NGS). The PAQMOS-26m on the other hand, provides a single-point measurement of the vertical variation of wind speed and temperature, *i.e.*, lower boundary-layer stability. Its site was chosen to be representative of the stability conditions of the surrounding inland region.

Briefly, for the Pickering Mesonet, a PAQMOS-10m (Figure A.1) consists of three 3m-long aluminum sections which were easily transported and assembled on site. It is held up with nylon guy ropes extended in four directions from three levels. At the top of the post (10m level) resides an anemometer, while a thermometer/humidometer (also referred to as a T/H sensor) is installed on a mounting arm at the 1.5m level within a vaned, self-ventilating radiation shield. A

barometer is also attached to the post at the 1.5m level. A datalogger (within its environmental enclosure) is mounted directly on the post as are a solar panel and auxiliary battery.

The PAQMOS-26m (Figure B.1) consists of nine 10-foot steel sections which were assembled and raised on-site by a crew of three without the use of heavy machinery. The tower is guyed in four directions with steel guy wires at four levels and cannot be climbed. Cup anemometers are mounted at the 1.5m, 4m ,8m, 16m and 26m levels on short boom arms. Thermocouples are mounted at the same levels in multi-plate radiation shields. They are arranged to provide differential temperature measurements with respect to the 1.5m reference. (The absolute 1.5m temperature is measured at the adjacent PAQMOS-10m.) Like the PAQMOS-10m, the PAQMOS-26m supports a datalogger in an environmental enclosure, a solar panel and an auxiliary battery.

2.2 PAQMOS-10m Instrumentation and Measurements

The heart of the PAQMOS-10m is the Campbell Scientific CR21X Micrologger. It provides excitation for (some of) the sensors, measures the analogue and pulse outputs of the sensors, converts these outputs to engineering units, stores the data in memory and can upload the data to a portable computer on-site or via telephone or radiotelemetry links. It has its own internal rechargeable lead acid batteries and is mounted in an environmental enclosure attached to the post.

An auxiliary 12V rechargeable battery system, designed and built at AES, provides extra energy storage for the system. In the event that the system's energy level drops too low, the auxiliary battery can very easily be replaced with another which is fully charged. This was necessary in the winter months of late 1988. We suspect that the datalogger internal batteries have begun to lose their full energy storage capacity as they have been used for more than four years without refurbishing. We hope to replace all of the internal datalogger batteries within the next few months.

A Solarex SX-5 solar panel restores energy to the system when conditions are favourable for photo-voltaic generation. Experience has shown that this size (nominal 5W) is adequate for the Southern Ontario climate when the logger and auxiliary batteries are capable of their full storage potential.

Wind speed and direction measurements are made with an R.M. Young 'WindMonitor' (Model Number 05103). To assure the quality of the wind speed and direction data, the WindMonitors were calibrated in the AES Boundary-Layer Wind Tunnel facility before the experiment. They have not yet undergone re-calibration or preventive maintenance.

During the CASP experiment, temperature and humidity measurements were provided by MetOne 083C/5300 Series Sensors mounted in MetOne 071 Radiation Shields. These proved somewhat unreliable but were all we had available initially for some sites in the Pickering project. They were deployed for temperature measurements only. At other sites, these failing sensors were replaced with Rotronics MP-100F temperature/humidity sensors mounted in the same shields. The temperature and humidity devices were not individually calibrated. Instead, we relied on the manufacturers' guarantees of accuracy and interchangeability. While the accuracy of the initial (MetOne) T/H sensors was acceptable, their reliability was quite poor and, as stated above, we are gradually replacing them with the Rotronics sensors. Unfortunately, these sensors also had reliability problems in their initial 5VDC(regulated) configuration. We found, however, that the 8-to-30VDC(unregulated) versions proved to be much more satisfactory while exhibiting good accuracy. At present, we are hoping to upgrade all of the temperature sensors to these models.

The MetOne 090B Barometric Pressure sensor provides pressure measurements. These electronic barometers have not been calibrated individually, but when they were installed the offsets were adjusted using an accurate, portable AES 'Inspector's Barometer' (Negretti and Zambra, model Mk.II). This proved sufficient to provide high quality, accurate station pressure measurements until some of the barometers began to fail in the latter months of 1988. We do not understand the reasons for these failures, nor does the manufacturer. We hope to sort out this problem in the next few months.

For reference, a wiring list (analogous to a wiring diagram) is included in Appendix C. This list is comprehensive in the sense that the system hardware could be re-assembled using this list. Also included in the appendix is a program listing derived from Campbell Scientific's PC208 program EDLOG. Like the wiring list, this program listing can serve for a complete regeneration of the datalogger software for the system except for insertion of the post identification number and calibration coefficients which apply to individual sensors.

Table 1 describes the measurement parameters for the PAQMOS-10m. Further discussion of the measurements obtained can be found in Section 6.2. The latter portion of Table 2 also provides information on the measurements made at each post. Tables 2 (for the PAQMOS-10m's) and 4 (for the PAQMOS-26m) are derived from the master data parameter files of the PAQMOS data handling system. Each measurement is identified by a number. For example, wind speed is 1, wind direction is 5, *etc.* The number in the second column defines whether the measurement is a scalar (1) or vector (2) measurement. (Note that vectors must occur in pairs with magnitude appearing before direction.) The next column contains a short (mnemonic) label for the measurement while the following column contains a full label. The next column denotes the unit of measurement. Column 6 gives the height of the measurement above the base of the PAQMOS-10m. The actual altitude of the measurement can be obtained by adding this height to the elevation

of the station given in the first part of the table. In the next section of the table, columns 3 and 4 give low and high rejection values for the particular type of data to which they apply. For example, for wind speed, any piece of data uploaded from the datalogger which is less than $0.0ms^{-1}$ or greater than $50ms^{-1}$ is assumed to be an error of some kind and is rejected and replaced with a flag value (1.0E25) in the data archive.

2.3 PAQMOS-26m Instrumentation and Measurements

The PAQMOS-26m uses the same datalogger (Campbell Scientific CR21X), auxiliary battery (AES design) and solar panel (Solarex SX-5) system as do the PAQMOS-10m's.

Wind speed measurements are made at 5 levels (1.5m, 4m, 8m, 16m and 26m) with Gill 3-cup anemometers (model 12102). These are d.c. tachometer generators which produce a voltage proportional to the rate of revolution of the cups and hence proportional to the wind speed. The datalogger measures the voltage output and converts it to a wind speed. The anemometers were individually calibrated in the AES wind tunnel prior to their deployment on the PAQMOS-26m.

Temperature differential measurements are made with a series of 5 copper/constantan thermocouples mounted in 6-plate Gill radiation shields. All of the differential measurements (4 of them) are referenced to the 1.5m thermocouple by joining all of the constantan leads together inside the datalogger enclosure (where they are electrically floating) and by making the 1.5m copper lead the reference for the other voltage measurements.

A wiring list for the PAQMOS-26m is included in Appendix C. This list is comprehensive, as for the PAQMOS-10m. A program listing derived from Campbell Scientific's PC208 program EDLOG is also included. As described for the PAQMOS-10m, this program listing can serve for a complete regeneration of the datalogger software for the system.

Table 3 describes the measurement parameters and is the PAQMOS-26m equivalent of Table 1. Further discussion of the measurements obtained can be found in Section 6.2. The latter portion of Table 4 also provides information on the measurements made on the PAQMOS-26m and is derived from the master data parameter files of the PAQMOS data handling system. (Note that the PAQMOS-26m data are handled by the PAQMOS data handling system. The single PAQMOS-26m is considered to be a network with only one station.) The description of Table 2 found in the previous section applies also to Table 4.

3 MESONET GEOGRAPHY

3.1 Introduction and Overview

A map of the area is given in Figure 1. The Pickering NGS is located on the shoreline of Lake Ontario about 30km to the east-north-east of the central core of the city of Toronto. Oshawa lies 20km further east-north-east and the rapidly expanding town of Pickering is about 5km north of the NGS. Although the prevailing winds at Toronto International Airport (which lies just to the north-west of the city) have a definite westerly component (see Table 5a taken from the 1951-1980 Canadian Climate Normals) the major centre of population in the area is Toronto and we decided to install most of our secondary stations to the west of Pickering, several along the path between the NGS and the city. In this context it is also interesting to compare the climate normals for Toronto International Airport with those for the Island Airport, on the Lake Ontario shoreline. Island Airport data are given in Table 5b and show a different distribution from that found at the International Airport. Winds from the east (using 16 direction groups) occur 15% of the time on an annual basis and over 20% of the time in spring and early summer.

The siting of the primary station caused some difficulty since no suitable location could be found within the grounds of the NGS or close by. We eventually decided to use the location at Cherrywood as being representative of the terrain between the NGS and potential receptors. It is 8km north-west of the NGS and 6 km from the Lake Ontario shoreline.

As noted in Section 1, we installed the one Primary and eight Secondary stations as a demonstration of the type of network we regard as desirable to detect mesoscale variations in wind field and dispersion characteristics for both emergency response and safety analyses of Nuclear Generating Stations. It was not intended as a permanent network and indeed we did not expect to operate it beyond the initial 6 month trial. On this basis, and in view of the need to get the project under way quite rapidly, our selection of sites was rather *ad hoc* and some of them will fall rather short of the criteria usually applied to AES climatological stations. We would also emphasize the difficulties encountered in finding reasonably secure and representative sites in this heavily populated area and the fact that we were deploying a restricted number of stations. The sites selected (PN1 to PN9) are described in the section below and are shown on the accompanying map (Figure 1). Upon reflection we would note that sites 3 and 8 are perhaps closer together than might have been ideal, that additional stations on the lakeshore both east and west of Pickering would be desirable and that a station west of PN1 and north of PN6 would have helped to complete the network pattern. Also, we were forced to abandon PN4 at Claremont part way through the year due to repeated vandalism to that station. This was the station furthest inland and should certainly be replaced,

to assist in the definition of lake-breeze and drainage flow circulations, if a permanent network is established.

3.2 Individual Site Descriptions

This section provides brief descriptions of each of the mesonet sites used. The exact locations are identified by grid references on the 1:50000 National Topographic Maps indicated. Acquisition of a set of these maps, including sheets 30 M/11, 30 M/14 and 30 M/15 is recommended as useful background for detailed studies using the Pickering Mesonet data. A complete set of N,E,S,W photographs of each site are available; we will use a selection of these to illustrate the sites.

Primary Station, **PN1** - Cherrywood Map 30 M/14 493 567

This station is on land presently controlled by Ontario Land Management, Green River, and farmed by Mr. Brian Hollinger. It is in a relatively flat pasture field with reasonable exposure from all directions. The closest wooded areas are about 100m to the west while there is a small group of trees about 200m south of the towers and trees and farm buildings about 160m to the east. Figure 2a shows the PAQMOS-10m and the exposure to the east, including the farm buildings. The Ontario Ministry of the Environment's acoustic sounder, which operated for part of the year, was located near the larger of the barns shown. The site is well removed from roads and security is good. The PAQMOS-26m is shown in Figure 2b which is a general view to the north taken shortly after the towers were installed. The line of trees to the north is about 200m distant. In the summer, grass levels in the pasture grew to approximately 1m and may have had an influence on the lowest levels of wind and temperature observation. Figure 2c is a sketch map of the local terrain, based on a survey of distances to field boundaries, *etc.*

Secondary Stations, **PN2-PN9**

These each have a PAQMOS-10m as described above. Note that some stations were initially set up with Met-One, temperature-only sensors in place of Rotronics T/H sensors. Stations with no humidity measurement are identified by * below.

Sites for the stations are,

PN2* - Pickering NGS Map 30 M/14 560 523

This site is near the waterline within the NGS plant site. It has good exposure from the lake but is less satisfactory for offshore winds due to the presence of a low (approx 5m) escarpment about 40m from the tower. This can be seen in Figure 3a showing the exposure to the east while

Figure 3b shows the mesonet station with Pickering NGS in the background to the west.

PN3* - Greenwood Map 30 M/14 558 623

The Greenwood site is near the gatehouse of the Greenwood Conservation Area, Metro Toronto and Region Conservation Authority. The area is generally wooded but the station is located in a clearing, approximately 50m from trees to the south and east. The generally wooded nature of the surrounding area will tend to lead to lower wind speeds at this location relative to many of the others. Figure 4 is a view of this site looking to the north.

PN4 - Claremont Map 30 M/14 498 683

The site selected was in field northeast of the junction of Concession 8 and Sideline 20 on land controlled by Pickering Airport Lands Office, Brougham. This site was operated from the beginning of the year until early July when it was abandoned because of repeated problems with vandalism. Exposure at the site was very good with only minor obstruction from isolated trees. Figure 5 is a view of the station looking to the north.

PN5 - East Point H.C.T.P. Map 30 M/14 492 477

This site is near the lakeshore at the eastern boundary of the area which could be loosely described as 'Greater Toronto'. It is on a low (approximately 4m), grass-covered ridge in a secure, sewage works area to the west of Highland Creek, and about 300m from the lake. A site closer to the lakeshore might have been preferable but there were security concerns at the alternative locations. There will also be some minor 'speed-up' effects associated with the ridge but the site was considered the best available in the area. Figure 6 shows the station with Pickering NGS in the distance, along the lakeshore to the east.

PN6* - Scarborough Map 30 M/11 391 453

This suburban site is just southeast of the intersection of Lawrence Ave. and Kennedy Rd., on Ontario Hydro property at the Scarborough Transformer Station. The station was installed slightly late, on Jan 12 1988. As with any suburban location, a representative site with good all-round exposure is hard to find and compromises have to be made. The Scarborough site in an area of short grass to the northwest of 2-storey buildings. It has good, clear exposure to the north, east and west, but poor exposure to the south and southeast. Figures 7a and 7b illustrate this with photographs looking east and south respectively.

PN7 - Toronto Map 30 M/11 338 415

After some deliberation we selected an 'urban' site on the roof of the Science Centre, 'A' building. We would have preferred a ground level site but, in this densely populated area, we felt that security was a major consideration and that, in an area surrounded by high-rise buildings, a flat roof on a low building offered the best choice. Figure 8 is a view of the station and it's exposure to the north. There are similar high-rise buildings to the east but the area to the south and west of the Science Centre is mostly parkland and overall exposure is better.

PN8* - Ajax-Audley Rd. Map 30 M/14 604 609

This site to the northeast of Pickering NGS is in the Ajax area in an open field on property belonging to the Audley Rd. Stables. The station was installed Jan 6, 1988. All round exposure is very good with the site being on a slight rise. Figure 9 illustrates this with a view to the east.

PN9 - Oshawa Airport Map 30 M/15 684 657

This site on the north side of Oshawa Airport also has excellent all round exposure. There are some trees and buildings about 400m to the north but in general it is an ideal 'airport' site. It is illustrated by Figure 10 showing the exposure to the west.

4 DATA COLLECTION PROCEDURE

4.1 Time Base

Before proceeding with the description of the data collection procedure, it is important to note that the time base used for the Pickering Mesonet is Eastern Standard Time (EST). All times quoted will be EST.

4.2 Procedure

Data collection is performed as described in Appendix A - by travelling from post to post more frequently than the interval in which the data capacity of the logger is reached (12.52 days for 13 values stored every 10min) and data overwriting begins. At the post, the data are uploaded to a diskette in a Toshiba T1100+ laptop microcomputer. So that the uploading can be performed in any weather conditions, the microcomputer is housed in a weather-resistant case with an umbilical cord which plugs into the datalogger. A combination of in-house and Campbell Scientific software is used to transfer the data. The microcomputer software is set up to perform the complete data transfer sequence from the AUTOEXEC.BAT file as

soon as the computer is powered up. No intervention is required, except to exchange diskettes when they become full of data.

So far, data have never been lost from the mesonet due to an inability to upload the data before the logger began to overwrite its old data. Occasionally data have been lost because of an internal malfunction in the datalogger itself (usually caused by too low a battery voltage). Fortunately these occasions were rare. Data have never been lost due to computer malfunction, and software and hardware back-ups were always available.

5 DATA PROCESSING AND QUALITY CONTROL

5.1 Data Processing

After the data are collected, the diskettes are brought back to the archive computer and the data are transferred to the hard disk using the serial ports of the two computers and proprietary software (LapLink). Program TNCDA of the PAQMOS data processing system is then invoked to transfer the data from the sequential, single-post, comma-delimited-ASCII files collected at the posts to the direct-access, synoptic (all posts) binary files of the data archive.

5.2 Automatic Quality Control

During the conversion of the individual data files into the archive files, every piece of data is examined to determine whether it falls within the acceptable limits shown in Table 2 (PAQMOS-10m's) or Table 4 (PAQMOS-26m). If not, it is noted, automatically rejected and the cause of the out-of-range value is investigated.

5.3 Manual Quality Control

For the 1988 data, the automatic procedures removed some of the bad data associated with instrument, battery or logger failures but our final checks were manual. As a part of the field data collection procedure, records are kept of all data transfers in a log file (LOGINQ.LOG). A sample printout of one of these is shown in Table 6. It includes information on any time offsets which could have developed between the individual dataloggers and NRC standard time, recalling that the clock in the Toshiba 1100+ microcomputer will have been set to that time just prior to setting out on the data transfer site visit, and lists the current values in each of the active data input channels of the datalogger. These values allow immediate identification of faults in the field and are also reviewed as a part of the manual

quality control process. The LOGINQ.LOG file also contains error messages put out by the datalogger. The only such message that we encountered occasionally was, 'Datalogger reset by watchdog'. It appears to be an error state encountered as a result of low datalogger battery voltage. The data transfer program, TNCDA, generates useful information on the numbers of records processed and errors detected by the automatic quality control tests. A sample is shown in Table 7. This output is reviewed and any errors investigated.

The main stage of the manual quality control procedure is to generate and inspect 10-day time series plots of all of the processed data using the TNTPL program described in Appendix A. Figures 11 and 12 are samples of the plots produced from the PAQMOS-10m's and PAQMOS-26m, respectively. Figure 11 has been chosen to illustrate one of the problems encountered. All such plots were routinely examined. Inspection of the plots for an individual tower sometimes revealed problems not caught by the range tests. Examples included occasions when the datalogger pulse counter had 'locked', leading to a zero pulse count and a constant, near-zero wind speed and occasions when a pressure sensor had developed a noisy output signal, as shown in Figure 11. In addition to inspecting individual plots, we also compared the time series from several stations in cases where we were suspicious of the values reported by an individual station. This step could help identify problems such as direction or temperature offsets at individual stations. Data which were identified as being erroneous were edited out of the archive using the TNKED program. Only a relatively small volume of data were removed in this way to begin with, but as several of the pressure sensors became noisy towards the end of the year, the manual quality control step became more important.

6 THE DATA ARCHIVE

6.1 Introduction

For the PAQMOS-10m network, the primary data archive consists of daily synoptic files of 10-minute averages of the 9 measurement parameters listed in Table 2. The PAQMOS-26m primary archive is comprised of daily files of 10-minute averages of the 14 measurement parameters of Table 4. Note that the PAQMOS-26m measurements were changed in mid-February to include standard deviations of the wind speed. The archive previous to this does not contain these data. The format of the archives is described below. As it is being produced, each archive is stored on the hard disk of the archive microcomputer. Backups on 'Bernoulli' cartridges (20Mb) are made regularly. As the 1988 measurement year has ended, the complete quality-controlled 1988 archives (PAQMOS-10m network and PAQMOS-26m) have been copied on to a Bernoulli cartridge with backups. The distribution format for the data is described below along with the data quality and availability.

6.2 Data Quality

Overall performance of the system was good but ageing batteries and failing sensors have led to some data losses. Some problems occurred with the measurement of humidity since we were unable to obtain sufficient T/H sensors with good humidity performance at the start of the project and others failed during its course. The pressure sensors started to give problems part way through the project and pressure data were lost from more than half of the stations by the end of the year. Our philosophy has been to reject suspect or noisy data so that we have high confidence in the final data archive.

6.2.1 Wind Speed and Direction

As noted above, all of the R.M. Young Windmonitors were individually wind-tunnel calibrated prior to their deployment in this project. For wind speeds we have no concerns about the reliability of the archived data and would assert that they represent measurements which are accurate to $\pm 0.2 ms^{-1}$. There will however be some local site effects on the measured winds. In particular at PN3 wind speeds will be rather lower than average due the wooded areas surrounding the site and at PN6 there will be low wind speeds for southeast flows due to building wake effects, as discussed in Section 3.2. The lower wind speeds at PN3 are evident in the annual and monthly averages given in Tables 8 and 10. The procedure for setting the wind direction at individual stations is described in Section A.2.5 of Appendix A. Some errors are possible in this operation but in general we would expect the anemometer alignment to be done with an error of less than $\pm 5°$. An additional source of possible error is degradation of the potentiometers used by the Windmonitors to report direction. We have no real evidence of this in the data but will recalibrate the potentiometers when the stations are removed or refurbished. As an initial estimate we would suggest that such errors will be less than 5° so that the overall accuracy of the wind directions would be better than $\pm 10°$. Larger errors than this should be detectable as persistent offsets in direction between stations. As a rough check on this we can look at monthly average wind direction data. Table 10 provides this information and generally shows that, except in the summer months when lake breeze effects could play a role, the monthly averaged wind directions from all stations with 100% data availability fall within a 20° band.

6.2.2 Temperature

Temperature data from the 10m posts appear to be generally reliable and accurate. The absolute accuracy is hard to establish since most of the error will be caused by imperfect aspiration of the sensors in their radiation shields and will be wind speed

and solar radiation dependent. In moderate winds the recorded temperatures should be accurate to ±0.2C but errors of 1C or greater could occur in light wind, strong insolation conditions. Temperatures were measured at each station with a sling psychrometer during most data collection visits. Discrepancies of order ±1C were often found and attributed to a combination of factors including incomplete thermal adjustment of the sling psychrometer. Monthly averaged temperatures for the stations are in reasonable agreement as shown in Table 10 with any differences being attributable to topographic, lake and urban heat island effects. This agreement suggests that relative accuracy should be better than the error estimates given above. In a final, manual quality control check, we did identify and delete one period of anomalously low temperature data at station PN3 from JD278-306 (JD, Julian Day). The temperatures were consistently lower than surrounding stations by about 4 to 5C during this period but we were unable to determine the cause of the problem. Data following JD306 appear to be perfectly normal.

6.2.3 Humidity

As noted earlier, we were unable to obtain humidity sensors for all of the stations and, in the end, they were only installed at PN1, 4, 5, 7 and 9. The sensor at PN7 failed part way through the year but was later replaced by the unit from the station at PN4, which was abandoned. Thus at year's end we were reduced to four stations with humidity data. The absolute accuracy of these data are difficult to assess. We did, for a while, check wet bulb temperatures as well as dry bulb with the sling psychrometer during data collection site visits. These were for rough checks on performance and we generally found agreement to within about 10% relative humidity. Sling psychrometer values are however not that reliable and could not really be used as a test of absolute accuracy. Comparison of monthly average humidity values at the stations (see Table 10) generally shows agreement to within ±3% or better and the ranges at all stations, as indicated by the standard deviations, are similar. One exception to this appears to be the relatively low values from PN7 during November and December. Comparison of the data for different stations for that period is not conclusive but does suggest that the PN7 sensor could be reading slightly low on some occasions. Inasmuch as that station is in a non-standard, rooftop location, however, there may be a physical explanation for the discrepancy and we have left the data in the archive at the present time.

6.2.4 Barometric Pressure

As noted above the reported values are station pressures with no adjustment to mean sea level. The monthly averages for each station will thus be different. The differences will reflect elevation differences and any offset errors in the individual barometers. Our main concern on the mesoscale is with short period pressure tendencies and the identification of meso-highs and lows. Absolute accuracy is not

of critical importance. Given these limitations we were satisfied with the initial performance of the pressure sensors but we soon began to notice that some sensors were giving noisy or bad data. As noted in Section 2.2 we have been unable to determine the source of these problems or to rectify them and have thus had to remove bad barometers from some of the stations and carefully check the data from the others. As a result we have deleted a significant amount of pressure data from the archive, as can be seen from the 'Data Availability' section of Table 8. As a general guide to relative accuracy, once height and instrument offsets have been removed we would estimate that the archived pressure data should be correct to ±0.02kPa.

6.2.5 PAQMOS-26m - Wind Speed, Variance, Temperature Differentials

The quality and reliability of the wind speed, wind speed variance and temperature difference data from the 26m tower are excellent. Wind speed variance data collection did not start until JD056. Prior to that we had 100% data recovery and between JD056 and JD366 only about 50 hrs data were lost. The cup anemometers were individually wind-tunnel calibrated prior to deployment and all appear to have performed satisfactorily throughout the year. The cup anemometers have slightly higher starting speeds than the Windmonitors but should also be accurate to $\pm 0.2 ms^{-1}$. We have not yet had sufficient experience with the variance data to put definitive accuracy estimates on them but would expect them to be accurate to $\pm 0.05 ms^{-1}$ or better. Long term average wind speed profiles are approximately logarithmic with a 'kink' at about 8m and speed variances increase slightly with height. Both features are probably a result of the tower being in a pasture field surrounded , at some distance, by trees and other areas of higher roughness. These expected behaviours give us added confidence in the data.

Temperature difference data will potentially suffer from similar aspiration errors as the PAQMOS-10m temperatures, but since we are now dealing with differences we can reasonably expect errors at different levels to partially offset each other. The thermocouples were tested in the laboratory prior to installation to check the calibration coefficients being applied and we would expect the temperature difference data to be correct to ±0.1C or better. Reported temperature differences are usually very close to 0C in moderate to strong winds providing added confidence in the performance of the system.

6.3 Data Distribution

There are two separate data archives for the Pickering Meteorological Monitoring Network. The first stores the data from the PAQMOS-10m network; the second stores the PAQMOS-26m data. There are also two data archive formats. One is used by the authors and consists of MS-DOS, FORTRAN, binary, direct-access files.

The data in this format are available almost instantaneously to the programs of the PAQMOS data handling system. The second format, MS-DOS comma-delimited-ASCII, sequential files, are used to distribute the data to interested parties.

Within each of the PAQMOS-10m and PAQMOS-26m direct-access archives the data are stored synoptically in files which contains one day of data each. For the PAQMOS-10m the files are named P7PQ88.nnn where nnn is the Julian day in 1988. For PAQMOS-26m the files are named P7TV88.nnn. Within a file each record corresponds to the data collected at a single post at a single synoptic time period. The records are grouped first by time period and then by post number within the time period. Because of this rigid ordering of the data, the PAQMOS data handling system can find any piece of data within the archive in, at most, a few hundredths of a second. This speeds up data processing considerably. Note that the PAQMOS-26m is actually viewed as a degenerate network of only one post by the data handling system.

When the data are required for distribution, they are copied from the direct-access archive into sequential, comma-delimited-ASCII files. During the copying process, the system adds extra information to each record so that it can easily be identified. Within each record the data are in a specified order. The first 4 data values are as follows:

1. Year
2. Julian Day
3. Hour, Minute as HHMM
4. Post Number

The subsequent data values are in the same order as listed in Tables 2 and 4, which should be considered authoritative with regard to data definitions, units, heights of measurement, post locations, *etc.* Thus, a record in a distribution file from the PAQMOS-10m archive, for example, will contain 13 values in the following order: Year, Julian Day, HHMM, Post Number, SSPD, SGSSPD, MXSSPD, VSPD, DIR, SGDIR, TEMP, HUM, BPRES. Note that the records are arranged sequentially in time and by post as described for the direct-access archive.

The MS-DOS, comma-delimited-ASCII, sequential files are amenable to easy manipulation with text editors, FORTRAN, BASIC, spreadsheet programs, *etc.*

Arrangements to obtain the data archives (or subsets) can be made by contacting either of the authors. They can be distributed on most of the popular microcomputer magnetic media.

6.4 Archived Data Availability

Figure 13 summarizes the data availability for the PAQMOS-10m network. Each section of graph covers a 20-day period during the experiment. A series of five (possible) lines for each post (stations PN1 to PN9) serves as an indicator of the presence of quality-controlled data for each of wind speed, wind direction, temperature, humidity and barometric pressure in the archive. Where there is a continuous line, there are data for that parameter; where the line is missing, there are no data in the archive. The bottom line for each post corresponds to wind speed, the next one up is wind direction and then temperature, humidity and barometric pressure. In the case of the PAQMOS-26m, data were missing for only a few periods. These are listed in Table 11.

7 ILLUSTRATIVE DATA FOR SELECTED PERIODS

The intent of this section is to choose periods to illustrate situations where data from a single station, at either Cherrywood or the Pickering NGS, would not be sufficient to indicate the likely trajectory or diffusion characteristics of a puff or plume of contaminated air released from the NGS. In this discussion we shall use JD for Julian Day, the ordinal day of the year.

7.1 19-20 January 1988 (JD019,020)

This period was selected as being relatively typical of a wintertime, moderate-to-strong easterly wind situation. Figures 14 to 16 (which can also be produced in colour with better discrimination between stations) show the time variations in wind speed and direction and in the standard deviation of wind direction at all of the stations with reliable data. Winds were light and variable at midday on the 19th but then freshened and, as can be seen from Figure 14, winds at PN2 (Pickering NGS) reached speeds in excess of $15ms^{-1}$ around midnight. The wind directions at all stations were steady and close to due east throughout the night. There would thus be no difficulty in assessing the direction of travel of any released contaminant but there would be considerable difficulty in assessing its speed since wind speeds at the different stations varied from 5 to $15ms^{-1}$ depending upon the roughness of the upwind area. This factor also accounts for the differences in the observed standard deviations in wind direction shown in Figure 16. Data from PN2 indicate a very low value (about 5°) while at PN7 (Science Centre) the presence of large buildings upwind leads to increased turbulence, lower wind speeds and much higher values for wind direction standard deviation. The profile tower at Cherrywood reported near-neutral stratification as indicated by the temperature difference data plotted in Figure 17.

7.2 12 May 1988 (JD133)

The early morning hours of 12 May were characterised by light winds and strong radiational cooling. This is well illustrated by the data from two levels of the 26m tower at Cherrywood shown in Figure 18. Light winds developed during the day, probably associated in part with urban heat island and lake breeze effects. Figures 19 and 20 show the wind speeds and directions for all of the stations. Wind speeds built to around 4ms^{-1} by early afternoon at all stations but there are distinct differences in wind direction with the shoreline stations (PN2, PN5) reporting easterly winds and the others being almost southerly. Predictions of the trajectory of a plume based on data from any single station would be highly suspect and even with data from all of the stations this would be a difficult case to assess. Figure 21 shows the vector winds for three successive 10min periods following 14:00EST. These plots are in a format that we are using for a pilot project to look at combinations of surface mesonet and Doppler radar data and the coordinate system is based on the King City radar site. Wind symbols have one full tick for every 10knots (approx 5ms^{-1}) and the numbers prefixed with G indicate maximum 1s gusts in knots, temperature (C), and station pressure (mb, modulo 1000). The shoreline of Lake Ontario is also shown. Figure 21 shows substantial direction differences between stations and confirms that the wind pattern was reasonably steady at this time. From this information it might be reasonable to predict that a plume released from Pickering at surface level would follow the subjectively drawn trajectory indicated, somewhat tentatively, on the third of the plots. The wind directions recorded at Toronto International and Toronto Island Airports at this time (14:00EST) were both south-southwest with a speed of 37kph registered at Toronto International. During this study the mesonet data were not available in real time but telephone or radio communication with the stations is possible and if implemented could provide the information presented in Figure 21 in near real time.

7.3 30 July 1988 (JD212)

A severe summer thunderstorm associated with a rapidly moving cold front crossed the Toronto area from the west around midday on 30 July. Wind speeds and directions at the mesonet sites are shown in Figures 22 and 23. Strong winds accompanied the frontal passage with maximum gusts in excess of 20 ms^{-1} at some of our stations. Wind directions ahead of the front were generally southwest, veered to northwest as the front passed, backed to south and the returned to southwest by about 15:00EST. In this case on-line data from a mesonet system would be extremely useful, especially if used in conjunction with data from the Doppler radar at King City, in tracking the storms progress towards and past the NGS site. Had a release occurred at this time it would have been extremely difficult to predict its trajectory but a sequence of surface wind vector plots of the type shown in Figure

24 for the period 11:00-12:00EST would have provided valuable guidance for a forecaster attempting the task.

8 BASIC STATISTICS

8.1 Introduction

Tables 8 to 10 present some basic yearly and monthly statistics for the data collected during 1988 by the PAQMOS-10m network and the PAQMOS-26m. We present these here with a limited amount of discussion.

8.2 Yearly Statistics

Table 8 lists the complete year averages, standard deviations and data availabilities (see also Section 6.4) for the PAQMOS-10m network. The meanings of the column headers can be determined from Table 2 under 'Data Parameters'. Where '-N/A-' appears in the tables, no data were available for that post and parameter. For humidity, in some cases (Pickering, Greenwood, Scarborough and Ajax) there are no averages at all because the humidity portion of the sensors were never put into service at these locations. In the standard deviations portion of the table, some of the columns (vector wind speed, wind direction) are characterized with -N/A- because a standard deviation calculation on these quantities would not be very meaningful.

Data availability statistics for Table 8 list the percentage of data (compared to a complete year) used in the calculation of averages and standard deviations. It also provides a quick assessment of the reliability of the system as a whole. Of the sensors, the anemometers displayed the greatest reliability with data recoveries above 90%. It is important to note here that the statistic is for overall reliability, so that the anemometer figures reflect datalogger battery failures more than instrument failures (see Section 6.2). The temperature, humidity and barometric pressure sensors showed decreasing amounts of data recovery. Problems with the T/H sensors and the barometers have been discussed above (Section 6.2) and we expect to see a dramatic improvement in the data recovery figures when the suggestions of Section 9 are implemented. The figures for Claremont are all low (about 45%) since that PAQMOS-10m was removed in July because of repeated vandalism.

Table 9 presents 1988 average, standard deviation and data availability data for the PAQMOS-26m. Most of the previous comments, those for Table 8, can be applied to this table as well. Note that the meanings of the column headers can be found in Table 4. This table is broken into three sections (for two time periods) because the datalogger program was modified in mid-February to determine and log the

standard deviation of the wind speed for the remainder of the year. These statistics are found in the third part of this table. Note that the 99.3% data recovery in the third period is due entirely to a failure of the datalogger battery.

8.3 Monthly Statistics

Table 10 contains monthly statistics analogous to those presented in the previous section for the PAQMOS-10m network. They have been included to give an idea of seasonal component of the regional heterogeneity in the measured parameters.

8.4 Joint Frequency Distributions

As one of the reasons for installing the Pickering Mesonet was to gather data for a local climatology of the region, it is appropriate to include joint-frequency tables here which relate wind speed, wind direction and atmospheric stability class. The wind speed is broken down into six ranges and the wind direction into sixteen sectors. The atmospheric stability is represented by Pasquill class (A to F) as described in Golder (1972). Determination of the wind speed range and direction sector is straight-forward with the data taken from the PAQMOS-10m at the Cherrywood site. However, determination of the Pasquill atmospheric stability class from the PAQMOS-26m tower data is somewhat more arbitrary. Here, wind speed data are available at 1.5, 4, 8, 16 and 26m and temperature difference data (with respect to the 1.5m level) are available at 4, 8, 16 and 26m. Also, absolute temperature at 10m is available from the PAQMOS-10m post. The present method for assigning a stability class is described below.

The gradient Richardson number, Ri, is defined as

$$Ri = \frac{g}{T}\frac{(\frac{\partial T}{\partial z}+\Gamma)}{(\frac{\partial U}{\partial z})^2} \qquad (1)$$

where g, the gravitational acceleration is $9.8ms^{-2}$, T(z) (in K) is the ambient air temperature, Γ, the dry adiabatic lapse rate is $9.8x10^{-3}Km^{-1}$, U(z) (in m/s) is the mean wind speed and z (in m) is the height above the ground. Examination of the data reveals that both T(z) and U(z) show a z dependence which is quite close to logarithmic, especially at the four upper levels. If we assume this dependence, and use the identities

$$\frac{\partial U}{\partial z} = \frac{1}{z}\frac{\partial U}{\partial(\ln z)} \qquad \frac{\partial T}{\partial z} = \frac{1}{z}\frac{\partial T}{\partial(\ln z)} \qquad (2)$$

we can derive the following expression

$$\frac{Ri}{z} = \frac{g}{T}\frac{\frac{\partial T}{\partial(\ln z)} + z\Gamma}{\left(\frac{\partial u}{\partial(\ln z)}\right)^2} \qquad (3)$$

For the calculation of Ri/z, the logarithmic gradients of temperature and wind speed are derived from least-squares fits to the data at the five levels. The value of z is taken as the geometric average between the lowest and highest measurement levels (6.24m).

Golder (*op. cit.*) cites the following empirical relationships between the inverse of the Monin-Obukhov length, L (in m), and the Richardson number,

$$\text{Unstable:} \qquad \frac{1}{L} = \frac{Ri}{z} \qquad (Ri < 0) \qquad (4a)$$

$$\text{Stable:} \qquad \frac{1}{L} = \frac{Ri}{z(1-\beta Ri)} \qquad (Ri > 0) \qquad (4b)$$

where β is approximately equal to 7.

Golder's figure 4 is a nomogram which provides the Pasquill Class (A, extremely unstable to F, moderately stable) given 1/L and z_o (in m), the surface roughness length. This figure was used to determine Pasquill stability classes for the joint frequency Tables 12 to 25. Note that a constant value of 0.44cm was used for z_o. This value, derived by Walmsley (1989) in a recent study, applies to vegetation cover at Cherrywood. He also provides a value of 0.06cm for snow cover but it is out of the range of the Golder nomogram. Furthermore, if we wished to differentiate between the ground cover types, it would be difficult to determine when the ground was covered with snow. In any case, this is likely to be a very small percentage of the total time. It is interesting to note that we originally calculated z_o for each 10min averaging interval as a by-product of the logarithmic least-squares fit to the mean wind speed. Unfortunately a variety of effects including stability, internal boundary layers and terrain-induced perturbations conspired to make this procedure unreliable.

The calculations are summarized in Tables 12 to 23 which contain monthly joint frequencies (as %) of wind speed and wind direction by stability class. The data have been normalized by the amount of data actually available and not the potential total amount of data for the period. That is, if there are some data missing, the sum

of all frequencies will still be 100%. Fortunately, as can be seen in the tables, there is very little missing data in 1988.

Table 24 contains the yearly (1988) joint frequencies by stability class. It is similar to Tables 12 to 23 except for the period covered.

Finally, Table 25 contains the yearly joint frequencies for all stability classes lumped together.

9 PROBLEMS, SOLUTIONS, SUGGESTIONS

9.1 Temperature/Humidity Sensors

The MetOne T/H probes originally installed in the mesonet proved to be very unreliable for humidity and fairly unreliable for temperature. As mentioned in Section 2.2, some of these were replaced by Rotronics T/H sensors which required a 5VDC regulated power supply. These were chosen so that the power drain could be minimized by exciting the probe electronics only briefly while a measurement was being recorded. Again, these proved unreliable (and possibly slightly inaccurate), probably because the 5VDC probe is a modified 8-30VDC (unregulated power supply) probe in which some of the electronic protection is removed along with a voltage regulator. Subsequently, some 8-30VDC unregulated power supply T/H sensors were installed and these have happily proved to be reliable and accurate. Further experience (during the ERICA experiment along the Atlantic coast of Nova Scotia) has shown these sensors to be very reliable even in harsh maritime coastal conditions. We recommend that all of the T/H sensors be upgraded to this type.

9.2 Energy Supply

One of the main reasons for data loss from the mesonet can be traced to low system battery voltages. In the past, this has not been a major problem, but this year, as the datalogger batteries age, several occurrences of nearly dead batteries resulted in situations in which the portable microcomputer could not upload the data from the logger memory. We recommend that all of the logger internal batteries be replaced.

A contributing factor to this problem may be in the connectors on the cable from the solar panels. Originally, we had been unable to acquire high quality connectors and it appears in some cases that the vibration of the post on which the datalogger is mounted is sufficient to prevent good contact. In these cases, the charging of the system batteries by the solar panel is only intermittent. We recommend that all of the connectors be replace by higher quality connectors.

9.3 Barometers

During the latter half of 1988, several of the MetOne barometers developed significant, intermittent and simultaneous 'noise' in their measurements. We have made a reasonably rigorous attempt to discover what could trigger this sort of behaviour but have not had any success to date. The manufacturer cannot suggest a cause but has advised us to return the worst of the sensors for inspection. In view of this problem, as well as problems with the development of random offsets when transporting the barometers, we recommend that a replacement for the MetOne barometer be found when it reaches the end of its working life.

9.4 Vandalism

The Pickering Mesonet has been lucky to suffer vandalism at only one location. This is probably because most of the posts are situated well away from population centres and roads or within fenced-off compounds. Unfortunately, the post at Claremont was only a few metres from a rural intersection and seemed to attract undesirable attention. After the third incident of vandalism, the post was removed. In the future, we recommend that the posts be placed where they are not obvious and reasonably far from well-travelled roads if they cannot be fenced off.

9.5 Data Collection Method

The present data collection method has proved to work very reliably with no loss of data attributable to the collection method. It also has the advantage that a visual inspection of the post can be made at approximately weekly intervals. However, this method has a high cost in terms of labour. It takes one day (about every ten days) to visit all of the posts to collect the data. There is also about 100km of driving involved. Furthermore, a malfunctioning sensor is not detected for a week to ten days with this method. Finally, such a system is not suitable for a 'real-time' emergency network. We recommend that telephone modems and lines be installed at all the dataloggers. This has been done already with relative ease at the PAQMOS-10m and PAQMOS-26m at Cherrywood. Data are now being routinely collected from both loggers in a timely, inexpensive and expedient manner. Furthermore, it takes only the time required for a telephone call to get on-line to real-time data from that site.

9.6 Future Considerations

The periods selected and briefly discussed in section 7 above are not especially unusual and numerous other portions of the data set could be used to illustrate the

same points. We should also remark that the network deployed in this demonstration project is a limited one and that a more extensive network of on-line stations could clearly do a better job in defining the mesoscale surface wind field. As a long term goal we would seriously recommend that all nuclear generating stations near urban areas should be provided with permanent surface networks of this type, perhaps comprising between 10 and 20 stations. In the vicinity of a major centre such as Toronto this could be part of a more broadly based network covering the urban and surrounding areas, with several users of the data. Multiple use, for both routine and emergency situations would spread the costs and make the deployment quite feasible. The initial cost of a basic station (datalogger, telephone modem, wind speed, direction and temperature sensors) could possibly be brought down to around $6,000 and a superior station might cost about $10,000. It would not seem unrealistic for a group of users to budget $500K initial costs plus $100K per year operating expenses for a 50 station network around Toronto.

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APPENDIX A - The PAQMOS-10m

A.1 INTRODUCTION

Since 1981, the Boundary Layer Research Division of the Atmospheric Environment Service of Environment Canada has evolved a meteorological measuring system, now known as the Portable Air Quality and Meteorological Observing System with the acronym PAQMOS. The basic component of the system is an instrumented 10m post (the PAQMOS-10m) together with a Campbell Scientific CR21X datalogger. Present measurement capabilities include wind speed, wind direction, air temperature, relative humidity, barometric pressure and precipitation amount but can be expanded to include virtually any parameter. The ability to manipulate the measured quantities within the logger is almost unlimited and includes conditional sampling capabilities. The logger can store a substantial amount of data - up to 23434 individual data values. Power for the instrumentation is supplied by batteries which are recharged by a solar panel. The post needs to be visited only to empty the bucket in the precipitation gauge (if installed) or to upload the collected data (if remote data transfer has not been chosen) or to service the equipment after a breakdown. Remote data logging can be accomplished via direct wire link, telephone lines, line-of-sight UHF or VHF radio or a combination of the above. Because of the system's *in situ* data logging capabilities, a failure in the remote system is not a problem - data which were not collected during the down-time of the remote system can easily be collected later, once it is operational again.

The post and instrumentation are relatively light and compact (except possibly for the precipitation gauge and stand) and can be easily transported to a remote site in an all-terrain vehicle, trailered behind an all-terrain cycle or even 'back-packed'. The latter would require two installers to make two trips each.

This appendix describes the hardware, interfaces and software associated with the PAQMOS-10m.

A.2 HARDWARE

This section covers the hardware which comprises a PAQMOS-10m. It describes the post itself, the logger, auxiliary battery, solar panel, anemometer, temperature/humidity sensor, barometer and precipitation gauge as well as giving a few details of their installation. A subsequent section details the measurements made by these devices.

A.2.1 Post

A fully instrumented PAQMOS-10m is shown in Figure 1. The structural component consists of three 3m lengths of 35mm (I.D.) aluminum conduit and one shorter 'top section'. The bottom 3m section has a floor flange threaded on to it. The flange prevents the post from sinking into the ground in most circumstances. Where the ground is very soft (*e.g.*, mud, sand *etc.*) the floor flange can be nailed into a large board for greater resistance to sinking. The three long sections are joined by two 'connectors' which simply slide into the conduit. The top section has a connector permanently attached (*i.e.*, bolted through) at its lower end which slides onto the top of the uppermost 3m section. From bottom to top, the top section consists of a short piece of the aluminum conduit, a female-to-female cast iron reducer and a very short piece of 25mm (I.D.) aluminum conduit. This configuration is sized to elevate an R.M. Young WindMonitor to 10m when it is mounted directly on top of the post.

The post sections require no maintenance and only a small amount of care to avoid bending them or crushing their ends. In very cold weather aluminum becomes quite brittle and greater care must be exercised, particularly with the long sections, when raising or lowering the post.

When standing, the post is held together under its own weight and the tension in the guy ropes. The guys are made from braided nylon rope and are reasonably long so that any one of them can be used at any of the three guying levels. On the post, the guy ropes are attached to screw eyes threaded into the connectors on four sides. A good knot, such as the bowline or clove hitch, is used for attachment. This makes it easy to replace a broken, worn or too-short guy with a minimum amount of effort. At the ground, a commercial 'line-tightener' is fitted onto the rope. The easily-adjusted line tightener makes final straightening of the post a relatively simple operation. A loop of rope tied through the attachment ring on the line-tightener is slipped onto a safety hook attached to a screw anchor in the ground. The 12 guy ropes are attached at three vertical levels (3m, 6m and 9m) in four directions as indicated in Figure A.1. The ropes stand up very well to solar radiation and other elements of the weather (including severe winter conditions) although they tend to stiffen up after a period of time. They seem to be of little interest to animals except for foxes who chew the ends and horses who like to scratch against them. In the case of foxes, spraying them with WD-40 lubricant seems to render them less appetizing. (It is not known what the long-term effect of WD-40 is on the guy ropes.) As for horses, the only solution found so far is to 'corral' the post so that the horses can't approach.

Experience has shown that the best way to anchor the guy ropes is with screw anchors turned into the ground. They work well for a variety of ground types and, in the case of very soft ground, are the only convenient method. An alternative in some circumstances (*e.g.*, frozen ground) is to pound a metal T-bar into the ground.

If it is not possible to install screw anchors or T-bars at the site then other arrangements can be made for securing the lower end of the guy ropes. For example, they can be tied to trees, large rocks, fence posts, *etc.* The screw anchors are 76cm long and have a 25mm eye on the upper end. Any convenient iron bar less than 25mm diameter and about 60cm long can be used to screw them into or out of the ground. A large hook with a safety closure is attached to the eye of the screw anchor using a double-looped length of the nylon rope. The loops from the line tighteners on all of the guy ropes from one side of the post are secured in this hook.

It is good practice to stand the post over a small 'centre post' (about 30cm long) which has been driven into the ground. This helps to site the post exactly where desired, as well as to give the bottom of the post a measure of stability especially during the raising and lowering operations. It is important that the centre post protrude only 2 to 4cm from the ground so that it can't catch inside the post and prevent it from being raised or lowered smoothly. It is possible to bend the post sections if this occurs.

The post should be erected in a clear space where tree branches or shrubs will not foul the guy ropes as they are raised with the post. The post can be erected on inclined ground if due allowance is made for the slope when laying out the length of the guy ropes. Normally, a gin pole is used to raise the post after it has been laid out on the ground. This method is preferred since there is less chance of inexperienced people damaging the post or installed equipment during the erection procedure. After the post has been raised, it is set straight and vertical using a method which combines a carpenter's level and sighting by eye.

It is possible for a single person to install a PAQMOS-10m using the standard 'gin-pole' method for raising the post from the ground. For convenience, though, it is desirable to have two people available for the erection. These two people, if they are experienced, can have the post erected and fully instrumented within two hours of arrival at the site. It is not unreasonable for a team of three people (an ideal number for installation) to install, instrument and commission four PAQMOS-10m's in a day assuming that travel time is not excessive.

A.2.2 Datalogger

The system uses a Campbell Scientific CR21X datalogger. The features which make it particularly useful for the PAQMOS-10m are 1) it can run for extended periods on rechargeable lead-acid batteries, 2) it can function in temperature extremes of -40C to +40C, 3) it has a variety of programmable input circuits capable of measuring single-ended or differential voltages and frequencies or pulsed signals, 4) it has programmable excitation circuits, 5) it can be programmed to manipulate the measured parameters in a multitude of ways including making logic decisions 6) it

has a 23434 data point internal memory, 7) it can communicate data or be programmed via modem and telephone or radio link or directly using RS232 protocol and 8) it has proven to be a very reliable solid state device.

For the PAQMOS-10m, the datalogger is housed in an environmental enclosure. There are two AMP 2/3-turn connectors on the bottom of this enclosure. One of these can be connected to a Gates 12V 5Ahr gelled, lead-acid battery. This external power supply supplements the internal 2.5 Ahr batteries. The second connector is connected straight through to the 9-pin 'D' connector on the datalogger so that there is access to the I/O capabilities of the logger without having to open the environmental enclosure. In the present configuration of the PAQMOS-10m, this connector is used by the operator to download data from the logger directly to a Toshiba T1100+ briefcase-sized microcomputer. It is also possible to communicate with the logger in a conversational mode externally using the Toshiba microcomputer and the appropriate software.

A 'grounding' rod is hammered into the ground near the post and a ground wire is run between the logger ground and this rod. This arrangement helps to protect the logger and instruments from stray RF noise and static electricity.

The environmental enclosure, containing the datalogger, is bolted to the lowermost section of the post using two U-bolts. It is recommended that the enclosure be mounted about head height so that the logger is comfortably accessible for wiring the sensor cables to the logger panel and for programming and checking. On the side of the enclosure is a standard electrical lead-through elbow where cables from the sensors are routed to be attached by screw-downs to the logger interface board. After all the cables are installed, the elbow is sealed (from the inside and the outside) with DuxSeal so that the logger is completely isolated from dust, humidity and other contaminants in the environment. Just before the door on the enclosure is sealed, two reactivated desiccant bags are placed inside.

A.2.3 Auxiliary Battery

The auxiliary battery is a Gates 5Ahr 12V gelled, sealed lead acid battery mounted in a 40cm length of 13cm diameter black PVC sewer pipe. A waterproof packing gland serves as a lead-through for the power cable which is terminated with an AMP 2/3-turn connector which is plugged directly into the bottom of the environmental enclosure. The construction of the battery case provides significant environmental and mechanical protection for the battery so that it can be installed in almost any location that the PAQMOS-10m can be placed. The construction of the battery itself allows it to be mounted in any orientation.

The auxiliary battery increases the total battery capacity of the system from 2.5Ahr to 7.5Ahr and thus increases the stand-alone endurance of the system by a factor

of three. The auxiliary battery is most frequently used in conjunction with a solar panel. This combination results in unlimited endurance as long as there is enough solar radiation for the solar panel to charge up the battery for the periods lacking solar input.

The design of the logger charging circuit allows the auxiliary battery to be installed or removed at any time without damage to the auxiliary battery itself, logger, stored data or program. Thus, it is quite practical to keep the system running by exchanging auxiliary batteries at intervals dictated by the power drain on the system.

The power cable from the auxiliary battery is fused (2A) within the PVC pipe itself to prevent damage to the battery or the logger in case of a short circuit in the system.

A.2.4 Solar Panel

In order to keep the PAQMOS-10m's running indefinitely without the bother of frequent replacements of auxiliary batteries, the system normally includes a Solarex SX-5 solar panel. Under most conditions (*i.e.*, excluding the high latitudes in winter conditions) the output of this panel is sufficient to keep a fully instrumented PAQMOS-10m (wind speed and direction, temperature, humidity, barometric pressure and precipitation) operational full time with reserve power for other measurement devices. If in doubt, it is not difficult to calculate the average daily output by the solar panel for any location with enough climate information (average direct and diffuse solar radiation amounts) and to decide whether there will be adequate energy produced to supply the known demand of the PAQMOS-10m. This balance will depend, of course, on what instrumentation is mounted on the post.

The solar panel does not have a 12V battery charging circuit associated with it since the logger has an excellent internal charging circuit. Therefore the solar panel is plugged directly into the logger and charges the logger's internal battery. It is fortunate that the logger's charging circuit is designed in such a way that the external battery is also charged with a regulated voltage. Thus, charging with the solar panel is extremely simple and effective.

The solar panel is mounted vertically on the lowest section of the post. Generally, the higher up it can be installed, the better. It is felt that the vertical orientation is a good compromise between energy collected, ease of installation and keeping the solar panel clean. This is particularly true in winter when snow can collect on an inclined panel. If necessary, the panel can be inclined (using a modified mount) so that the energy collection is increased. In the horizontal plane, the panel is oriented so that the collecting surface is pointed directly south. If there is something (a hill, building, *etc.*) which would obscure the panel for part of the day, it might be

necessary to choose another orientation - one which would maximize the amount of sunlight falling on the collector surface.

A.2.5 WindMonitor Anemometer

The WindMonitor anemometer, (model 05103, manufactured by the R.M. Young company) uses a horizontal propeller oriented into the prevailing wind by a tail vane to measure the wind velocity. It is rugged, easily maintained and easily installed. Speed is measured by counting the pulses produced in a coil by a six-pole circular magnet rotating with the propeller. The direction is sensed with a rotary potentiometer which has a 5° 'deadband'. The datalogger supplies the momentary excitation voltage necessary for making the direction measurement. A desirable feature of this anemometer is its low power consumption.

The WindMonitor is installed on the post when it is in a 'slightly raised' position, just prior to complete erection. The WindMonitor is slid onto the post and oriented so the deadband will correspond to the direction of least interest when the post is fully raised. The final direction adjustments are made in the datalogger program since the post cannot be climbed to make fine adjustments to the physical orientation of the anemometer in its installed position. The adjustment procedure is most easily accomplished with two people and involves steadying the anemometer with a piece of string looped around the anemometer tail and tied at the ground. The anemometer orientation is then measured from the ground with an accurate sighting compass. The wind direction output by the datalogger is adjusted for offset to correspond to the direction determined from the sighting compass. To finish up, the restraining string is slipped off the anemometer tail from the ground.

A.2.6 Temperature/Humidity Sensor

The temperature and humidity are measured with a combination thermometer and hygrometer (Met One, model 083C/5300 or, preferably Rotronics, model MP-100F) mounted in a vaned, self-orienting, wind-ventilated radiation shield. This device is mounted on a horizontal arm attached to the lowermost section of the 10m post so that the sensors themselves are 1.5m above the local ground. In the Met One sensor, temperature is measured in a simple thermistor bridge circuit with excitation supplied by the datalogger. The bridge is only excited momentarily with the differential voltage measurement being made after the excitation voltage has settled down. Relative humidity is measured by determining the capacitance in a thin-film capacitor. The sensor electronics are packaged with the sensor itself and require a continuous 12V unregulated voltage supply. In the Rotronics sensor, temperature is measured with a platinum resistance thermometer while humidity is sensed with a C-80 Hygromer. As for the Met-One, the sensor electronics are built into the probe package. They require (depending on the model) either a 5VDC regulated or

8-30VDC unregulated power supply. The high failure rate of the 5VDC model, however, has led us to abandon this model in favour of the 8-30VDC model.

We have not been fully satisfied with the performance of the Met-One sensor for humidity measurements and are gradually changing over to the 8 to 30VDC model Rotronics T/H MP-100F.

A.2.7 Barometer

The electronic barometer (MetOne, model 090B) uses a strain gauge and electronic sensing circuitry to sense the absolute barometric pressure. It is mounted in its own separate, environmental enclosure. A small aperture in the bottom of the enclosure allows the sensing surface of the strain gauge to maintain equilibrium with the atmospheric pressure. The barometer requires a continuous, unregulated 12V power source which is supplied by the datalogger.

The barometer is mounted on the post 1.5m above the ground.

A.2.8 Precipitation Gauge

The precipitation gauge (Belfort, model 5915) is mounted on a wooden base near the post so that the mouth of the collector is 2m above the ground. In the winter months, it is surmounted by a Nipher shield. The gauge functions by using a spring balance to weigh the amount of precipitation funnelled into a bucket. (In the winter, the bucket is initially charged with a small amount of anti-freeze which dissolves any frozen precipitation, preventing it from sublimating or blowing away in high winds. It also makes it easier to empty the bucket when it becomes full.) The weight of the precipitation is sensed as a voltage output by a rotary potentiometer connected to the spring balance gearing system. The momentary excitation voltage is supplied by the datalogger. The output voltage is converted to a precipitation weight by the logger and averaged over the logger averaging period and stored in the logger memory. The precipitation rate is calculated during subsequent data processing from the difference in weights between successive readings. A small amount of 'noise' can appear in the calculated precipitation rate. This noise seemed to be generated by slight fluctuations in the measured total weight caused by movements of the shield, gauge and stand in strong winds.

The precipitation gauge should be located where the incident wind will be minimally affected by local topography, vegetation, rocks, buildings, *etc.* but less than 20m from the post so that the signal cable can reach the logger. (This may mean taking the precipitation gauge location into account when trying to determine the optimum site for the PAQMOS-10m.)

The precipitation bucket must be emptied at intervals which depend on the amount of precipitation at each particular site. By monitoring the fluid level in the bucket, which is reported automatically during a data upload or can be determined from remote data reports, the field technician can readily determine when the bucket needs to be emptied.

A.3 SENSOR-TO-LOGGER INTERFACES AND SENSOR CALIBRATIONS

A.3.1 Introduction

Because of the sophistication and flexibility of the CR21X datalogger, the sensor-to-logger interfaces for the PAQMOS-10m are all very simple. The logger is capable of directly measuring voltage (single-ended and differential in several ranges) and frequency (continuous input or switch closures) so that a transducer which exhibits changes in any other quantity (*e.g.*, resistance) will require some signal conditioning before the measurement can be made and converted to the engineering quantity desired. The following sections briefly describe the sensor-to-logger connections and any interfaces which are used.

A.3.2 Wind Speed

The WindMonitor output is a continuous voltage sine wave with frequency directly related to wind speed. The number of cycles per second is measured by the datalogger and converted internally to engineering units (ms^{-1}) via a linear calibration equation. Each WindMonitor is individually calibrated over the range 0 to 20ms^{-1} to derive the multiplier and offset for the calibration. A filter circuit has been installed in the system. It is designed to prevent wind speed 'spikes' from contaminating the data. These spikes are thought to occur during dry conditions when static charge can build up on the polypropylene propeller and then discharge with the effect of producing a large number of spurious pulse counts in the wind speed sensing circuit. There is an ongoing investigation to try to understand the details of these wind speed 'spike' events, which, fortunately, are rare.

A.3.3 Wind direction

The WindMonitor direction is related to the resistance in a rotary potentiometer mounted in the vertical shaft of the anemometer. To obtain a measurable signal, an excitation voltage is applied to the potentiometer field coil and the voltage across the wiper is measured. This voltage is converted to degrees using a linear calibration equation. The offset and multiplier are determined individually for each Wind-

Monitor in a calibration procedure carried out before the WindMonitors are deployed. To save battery power, the CR21X datalogger is programmed to supply the excitation voltage .02s before the voltage measurement is made. Note that the offset calibration constant is over-ridden during the direction orientation procedure in the field. This does not affect the accuracy of the measurements.

A.3.4 Temperature

In the Met One sensor, the environmental temperature determines the resistance in a thermistor mounted in the temperature/humidity sensor. This thermistor is mounted in a bridge circuit to which a voltage is applied 0.02s before a differential voltage measurement is made. Note that the user must insert one arm (a 23.1KΩ resistor) of the bridge circuit at the logger. The logger converts the measured voltage to degrees C via a linear calibration equation. The temperature sensors are not individually calibrated.

In the Rotronics sensor, the temperature is measured with a platinum resistance thermometer. All of the electronics are built in to the sensor so that the output is a voltage which is directly proportional to the temperature. The Rotronics sensors are not individually calibrated.

A.3.5 Relative Humidity

The Met One humidity sensor is a complete electronic package which requires an unregulated 12V supply and outputs a voltage which is directly proportional to the relative humidity. The manufacturer calibrates each device individually so that the relative humidity equals the output voltage (in volts) times 100. The datalogger makes a differential measurement of the voltage and converts it to relative humidity in %.

The Rotronics humidity sensor works in much the same manner as the Met One humidity sensor except that it requires an unregulated supply voltage between 8 and 30 VDC.

A.3.6 Barometric Pressure

The pressure sensor is a self-contained, pre-calibrated unit which requires an unregulated 12V supply. The internal electronics converts the measured pressure to a voltage. The logger makes a differential measurement of this voltage and converts it into engineering units with a linear calibration equation. The pressure sensors are not individually calibrated - the manufacturer's published calibration equation is used.

Experience has shown that the pressure sensors generally exhibit an offset in the pressure measurement which should be corrected using a reference barometer after the unit is installed. This correction can be added directly into the offset of the calibration equation.

A.3.7 Precipitation

The precipitation gauge senses the weight of the collection bucket and its contents with a rotary potentiometer geared to an accurate spring balance. It is only necessary to apply an excitation voltage to the potentiometer (starting 0.01s before the measurement) and then to make a differential measurement of the output voltage. This is done automatically with a single measurement command in the datalogger which also applies the linear calibration equation to derive an equivalent depth of liquid precipitation. The precipitation rate is calculated directly in logger software using the difference in weights from one averaging interval to the next.

Generally, the precipitation gauge is calibrated using known weights in the bucket before it is taken into the field.

A.3.8 System Accuracy

The accuracy of the system as a whole (sensor, interface, datalogger and data transfer) is given in Table 1. Note that in the case of all the sensors, the accuracy is only as good as the calibration of the instrument so that the table should be regarded as a compilation of the 'potential' accuracy of the system. Note also that for the wind direction and the barometric pressure, the accuracy will depend on how well the *in situ* calibration offset is determined.

A.4 DATA ACQUISITION PROCEDURES

A.4.1 Introduction

This section describes the data acquisition and gathering procedures used with an array of PAQMOS-10m's. This includes programming the CR21X dataloggers, transfer of the data from the logger memory to diskette using the Toshiba T1100+ microcomputer and transfer of the data from the diskette to the hard disk of a more powerful microcomputer. The section begins with a brief description of the hardware associated with the data acquisition and gathering procedures.

A.4.2 Campbell Scientific CR21X Datalogger

The physical characteristics of the CR21X datalogger have been described in Section 2.2 of this report. This section will describe briefly the data handling and data transfer features of this device.

The logger memory is divided into input memory (called input locations), intermediate memory and output memory (called output locations). A transducer signal is sampled by the logger as a (milli)voltage or frequency, converted to engineering units using built-in procedures (linear or non-linear conversions) and stored in an input memory location determined in the logger program. The data stored in the input memory is manipulated by the logger program (*e.g.*, averaged, standard deviation calculated, maxima or minima determined, *etc.*) and then stored into output memory at intervals set in the logger program. There are 23434 output memory locations in a circular configuration. That is, the oldest data are overwritten by the newest data so that output memory location number 1 follows location number 23434. If the operator fails to extract the data at frequent enough intervals, the oldest of them are lost by overwriting.

The contents of the output memory can be accessed via an RS232-C serial port on the datalogger. The logger can be commanded (via the serial port) to send the contents of any contiguous segment of output memory locations, in ASCII or internal binary format, to a receiving device. In the case described here, the receiving device is the Toshiba T1100+ microcomputer.

A.4.3 Toshiba T1100+ Microcomputer

The Toshiba T1100+ microcomputer is an extremely compact (30cm x 30cm x 7cm) and portable (4.6kg) fully-functional IBM-compatible (*i.e.*, MS-DOS operating system) microcomputer with 640Kbytes of RAM storage, an LCD display (80 characters x 25 rows), two 3.5" diskette drives (720Kbytes storage each), an RS232-C serial port, internal rechargeable batteries with up to 5hr field life and many other features.

For use in the field, the T1100+ is packaged in a hard-sided case with a plexi-glass window which allows the operator to view the status messages on the LCD display as the data are uploaded. A flexible cable attached to the case routes the data from the connector on the logger enclosure to the computer. The T1100+ can be turned on externally. This initiates the data uploading procedure.

A.4.4 CR21X Programming

In general, the logger is programmed to measure and record averages of scalar wind speed, wind direction, temperature, humidity, barometric pressure and total precipitation amount as well as calculate and record average vector wind speed and standard deviations of scalar wind speed and direction over the averaging period. The sampling interval for all measurements is usually 1s. The averaging interval programmed into the logger is normally 10min. This a trade-off between time resolution and the logger storage capability.

Normally, a CR21X program is loaded into the logger's programming memory via a series of keystrokes on the front panel of the logger itself. However in the case of an extensive measurement array, this would mean loading a reasonably long and complex program into as many as to 26 loggers - a potential source of error as well as time wasted. Therefore, we use software available from Campbell Scientific, program TERM (from the PC208 package), that automatically downloads the logging program to the CR21X via the RS232-C ports on the microcomputer and logger. After performing the download, the operator is then only responsible for insertion of calibration coefficients unique to the particular instrumentation at each PAQMOS-10m site into the logger program. These are for wind speed and direction, barometric pressure offset and precipitation amount. Downloading of logger programs and insertion of calibration coefficients is usually performed at the field base station and the logger is then transported (while active) to the PAQMOS-10m site where it is installed.

At the site, the CR21X datalogger acquires all of the analogue and pulse signals routed to it from the various transducers (WindMonitor, T/H sensor, barometer, precipitation gauge). It measures the signals, converts the voltages or pulse rates to engineering units (ms^{-1}, °, C, %, kPa, mm/hr) and averages them for ten minutes while calculating the standard deviations. At the end of a 10min interval, the logger typically writes several values to its output memory. An example of a typical output record is as follows:

1. Table 1 statement identifier (always included)
2. Julian day
3. Time of day as hhmm
4. Station Identifier
5. 10min average scalar wind speed (ms^{-1})
6. 10min average vector wind speed (ms^{-1})
7. 10min average wind direction (°true)
8. Standard deviation of wind direction (°)
9. Standard deviation of scalar wind speed (ms^{-1})
10. 10min average of temperature (C)
11. 10min average of humidity (%)

12. 10min average of barometric pressure (kPa)
13. 10min average of precipitation bucket rate)

Values such as these would continue to be written consecutively in the output memory (every ten minutes) until the logger (or logging program) is stopped. However, the logger's output memory is never exhausted since it is configured as a ring with the newest data value overwriting the oldest as logging proceeds. If the investigator is to acquire all of the data produced by the logger during the experiment, he or she must remove old data before they are overwritten by new data. The overwriting period for this configuration (13 output values recorded every 10min and 23434 output memory data locations available in the logger) is 12.52 days. Therefore, the data should be uploaded from the logger to the T1100+ microcomputer at least every 12.52 days.

A.4.5 CR21X-to-T1100+ Data Transfer

The transfer of data from the CR21X output memory to a T1100+ diskette is accomplished by travelling to each PAQMOS-10m at intervals more frequent than, say, 12.52 days for our example above and transferring the data from the logger to the microcomputer memory via their RS232-C interfaces and then from the microcomputer memory to a diskette.

The actual mechanics of transferring the data from logger to microcomputer is designed to be as simple as possible. It requires only that the operator ensure that a master diskette be mounted in the microcomputer's A: drive and a data diskette be mounted in its B: drive. At the datalogger, he or she plugs a cable from the microcomputer's environmental case into the connector on the logger's environmental enclosure and turns on the microcomputer which uses the AUTOEXEC.BAT file for initiation of programs. All of the other details (including PAQMOS-10m identification, data selection, logger clock resetting, *etc.*) are handled by the microcomputer and logger. Occasionally, the microcomputer will ask for another data diskette to be installed, but otherwise no intervention is required by the operator. When all of the data are transferred from the logger to the microcomputer, the microcomputer informs the operator and he or she is then free to go on to the next PAQMOS-10m to repeat the procedure.

Logistically, an investigator would attempt to upload the data from all the PAQMOS-10m's within a one or two day period at intervals less than the maximum determined by the logger memory, 12.52 days in our example. In this way, he would have time to return to the base, transfer the data from T1100+ diskette to archive, hard disk storage and then examine them (usually by screen or hardcopy plots) for quality. If a problem had occurred in the data transfer, it would usually manifest itself in the transfer process or in the data plots. Because he or she had allowed some extra time, the investigator could then return to the site where the problem

occurred and attempt to re-transfer the data, since the (example) 12.52 day memory overwriting deadline would not yet have passed.

A.4.6 T1100+ Diskette to Archive Microcomputer Data Transfer

After the investigator has collected the data from the PAQMOS-10m's on diskettes, he or she transfers them to a larger microcomputer (the 'archive microcomputer') with a hard disk which has been set up for archiving the data in synoptic files. There are several reasons for doing this. The first is that the archive microcomputer has the capacity to handle the large data set generated by the PAQMOS system. Second, the archive microcomputer is much faster at retrieving, storing and processing the data than the T1100+. Third, the archive microcomputer has hard-disk storage and the ability to program in a sophisticated, high-level language such as FORTRAN so the entire data set can be stored on-line, in efficiently packed, unformatted, direct-access files for instantaneous access to any piece of data in the data set. Finally, during the transfer the individual time series for each PAQMOS-10m can be collated into a synoptic data set which is generally easier to use and to manipulate.

The procedure for the transfer is quite simple. The T1100+ microcomputer is hooked up to the archive microcomputer via their RS232-C ports and the T1100+ diskette files are transferred. Alternatively, the files can be read directly if the archive microcomputer has a 3.5" diskette drive. After the files are transferred, the archive microcomputer reads the files one by one, encodes the data into its own internal format, quality controls them and stores them into unformatted, direct-access files on the hard disk. Once the data are in this format, they can be manipulated by a variety of programs which are described in a subsequent section.

It should be pointed out here that some operator intervention is required in setting up the unformatted, direct-access files which store the data. The operator needs to create a 'master' file which contains all of the information necessary to describe the PAQMOS-10m array to the system. An example of most of the information included in a typical master file is shown in Tables 2 and 4. These summaries were generated simply by running a PAQMOS software system program. Setting up the master file might take up to an hour depending on the number of PAQMOS-10m's in the array and the number of data parameters measured and derived by the logger.

A.4.7 Archive Microcomputer Data File Format

As previously stated the data are stored in direct- (or random-) access files on the hard disk of the archive microcomputer (hereafter referred to simply as the microcomputer). The files are configured so that at each synoptic time (*e.g.*, every ten minutes) there are a series of records, one for each PAQMOS-10m, which

contain the measured parameters in an order which is predetermined by the master files. Note that the order of the records (*i.e.*, PAQMOS-10m's) is also determined by the master file. Each file contains one day of data. In the case of the 10min averaging and reporting interval there would be 144 sets of records beginning at 00:00 and ending at 23:50. Because the files are direct-access and the (fixed-length) records are found by position in the files, there are no gaps in the data format. If any data are missing, they are represented by an extremely large number (a flag, 1.0E25). While this is not the most efficient method of storage (unless there are no missing data at all, in which case it is the most efficient method) it allows instantaneous access to any single piece or combination of data in the entire data set.

A.4.8 PAQMOS Software

There is a suite of programs available for the archive microcomputer that allows the investigator to manipulate the data in a number of ways for presentation and simple statistical purposes. The following provides a brief description of each of these programs.

TNCDA

This program transfers data from the (comma delimited) ASCII data file originally uploaded on the T1100+ microcomputer to the direct access, unformatted synoptic archive files. During the process it does a number of framing and range checks on the data. Any data which do not pass these checks are discarded, *i.e.*, their values are replaced with the flag value, 1.0E25. Note that it creates the empty archive synoptic files 'on-the-fly' as they are needed and then fills them with the data as they become available.

TNSUM

This program prints out a summary of the information included in the master file for a PAQMOS array. It was used to produce Tables 2 and 4.

TNKED

This program allows the investigator to mark blocks of bad data in an efficient, interactive manner. A trace of all of the marked data is printed on the line printer. Note that the investigator can change data values with this program by multiplying the archive value by a constant and adding a constant (*i.e.*, a linear correction). This program is useful for sections of data that met the quality control criteria but are known to be unreliable for other reasons or for sections of data which need to be adjusted by some factor.

TNDAV

This program plots, on the screen or the plotter, a compact diagram which represents the availability of every piece of good data in the data set. This is very useful for a quick determination of the overall performance of the PAQMOS array as well as

to find out whether a particular subset of the data is available at a particular time. This program was used to produce Figure 13.

TNLST

This program makes a partial list of the data based on criteria determined in a question/answer session at the beginning of the program. Any subset of time, posts or data parameters can be listed to the screen or the printer.

TNAVG

This program averages the data values in any subset of time, posts or data parameters. It prints the averages, standard deviations and number of data values used for each average to the screen or printer. In the case of measured maximum values, it reports the maximum in the averaging interval and not the average of the maxima.

TNSVG

This program acts in the same way as TNAVG except that it performs a series of sequential averages, beginning and ending at operator-chosen times. The number of synoptic time steps for each average is chosen by the operator. This program, for example, could be used to calculate hourly averages for the whole data set at all post locations and for all measured parameters, from the basic data set with 10min intervals.

TNTPL

This program creates plots, on the screen or on the plotter, of the time series of individual data parameters. The plots are presented with four to the page and are grouped by individual post. As usual, the operator can choose any subset of the time, posts or data parameters to be displayed - all the rest of the necessary information comes from the master file so that there is only a brief question/answer session at the beginning of the program. A sample of this type of plot is shown in Figure 11.

TNSPL

This program is run in the same way as program TNTPL except that each plot (one to a page in this case) presents several time series of a particular, single parameter from any chosen subset of the posts. Again, the operator may easily choose any subset of the time, posts or data parameters to be presented. A sample of this type of plot is shown in Figure 14.

TNUTL

This program is a shell which contains all the master file handling and time, post and data parameter choosing routines as well as the code necessary to efficiently address any parameter, post and time step in the data set. At the core of the shell, the operator can insert the lines of (FORTRAN) code necessary to perform the computations not available in the other programs of the PAQMOS software.

APPENDIX B - The PAQMOS-26m

B.1 INTRODUCTION

The TallTower is a 26m meteorological profile measurement tower. In its normal configuration it measures wind speed at 1.5, 4, 8 16, and 26m and temperature differential between 1.5 and 4m, 1.5 and 8m, 1.5 and 16m and between 1.5 and 26m. It can be transported to the site in a van or pick-up truck and can be installed by two people using only hand tools. It does not require external power and can run indefinitely, drawing power from a solar panel mounted on the tower. The wind speed and temperature data are normally sampled at 1s intervals and stored as 10min averages. The datalogger can store about 12.5 days of data before the oldest data values in its circular memory are overwritten by the most recent values.

B.2 HARDWARE

B.2.1 The Tower

The tower itself is a commercial product called the Tall Tower, manufactured by NRG Systems of Bristol Vermont. It is comprised of 9 steel tube sections, 3.5m (10ft) long and 7.6cm (3in) in diameter, which slide together end-to-end without bolts or clamps to a total height of 26m. Also included is a hinged base plate so that the tower can be assembled on the ground and then tilted up with the aid of a 6m (20ft) gin pole (included with the tower). Any winch or come-along with a minimum working load of 450kg (1000lb) works fine. The tower is guyed at 6m (20ft) intervals in 4 directions. During the tilting, one of the sets of guy wires is attached to the gin pole while the two perpendicular sets are used for stabilization. Once the tower is raised, the guy wires are tied down to 1m (40in) screw anchors positioned 15m (50ft) from the base of the tower. During the erection operation, the tower is stabilized in an almost horizontal position, slightly off the ground. At this time, it is easy to install the instrumentation for the upper levels.

The PAQMOS-26m tower (along with all of the installation equipment required as well as the instrumentation) is easy to transport in a van or truck and requires no heavy equipment for installation.

B.2.2 Datalogger

The PAQMOS-26m uses a Campbell Scientific CR21X datalogger. The features which make it particularly useful are 1) it can run for extended periods on rechargeable lead-acid batteries, 2) it can function in temperature extremes of -40C to +40C, 3) it has a variety of programmable input circuits capable of measuring single-ended or differential voltages and frequencies or pulsed signals, 4) it has programmable excitation circuits, 5) it can be programmed to manipulate the measured parameters in a multitude of ways including making logic decisions 6) it has a 23434 data point internal memory, 7) it can communicate data or be programmed via modem and telephone or radio link or directly using RS232 protocol and 8) it has proven to be a very reliable solid state device.

For the PAQMOS-26m, the datalogger is housed in an environmental enclosure. There are two AMP 2/3-turn connectors on the bottom of this enclosure. One of these can be connected to a Gates 12V 5Ahr gelled, lead-acid battery. This external power supply supplements the internal 2.5 Ahr batteries. The second connector is connected straight through to the 9-pin 'D' connector on the datalogger so that there is access to the I/O capabilities of the logger without having to open the environmental enclosure. In the present configuration of the PAQMOS-26m, this connector is used by the operator to download data from the logger directly to a Toshiba T1100+ briefcase-sized microcomputer. It is also possible to communicate with the logger in a conversational mode using the Toshiba microcomputer and the appropriate software.

A 'grounding' rod is hammered into the ground near the tower and a ground wire is run between the logger ground and this rod. This arrangement helps to protect the logger and instruments from stray RF noise and static electricity.

The environmental enclosure, containing the datalogger, is bolted to the lowermost section of the tower using two U-bolts. It is recommended that the enclosure be mounted about head height so that the logger is comfortably accessible for wiring the sensor cables to the logger panel and for programming and checking. On the side of the enclosure are two standard electrical lead-through elbow where cables from the sensors are routed to be attached by screw-down terminals to the logger interface board. After all the cables are installed, the elbow is sealed (from the inside and the outside) with DuxSeal so that the logger is completely isolated from dust, humidity and other contaminants in the environment. Just before the door on the enclosure is sealed, two reactivated desiccant bags are placed inside.

B.2.3 Auxiliary Battery

The auxiliary battery is a Gates 5Ahr 12V gelled, sealed lead acid battery mounted in a 40cm length of 13cm diameter black PVC sewer pipe. A waterproof packing

gland serves as a lead-through for the power cable which is terminated with an AMP 2/3-turn connector which is plugged directly into the bottom of the environmental enclosure. The construction of the battery case provides significant environmental and mechanical protection for the battery so that it can be installed in almost any location that the tower can be placed. The construction of the battery itself allows it to be mounted in any orientation.

The auxiliary battery increases the total battery capacity of the system from 2.5Ahr to 7.5Ahr and thus increases the stand-alone endurance of the system by a factor of three. The auxiliary battery is most frequently used in conjunction with a solar panel. This combination results in unlimited endurance as long as there is enough solar radiation for the solar panel to charge up the battery for the periods lacking solar input.

The design of the logger charging circuit allows the auxiliary battery to be installed or removed at any time without damage to the auxiliary battery itself, logger, stored data or program. Thus, it is quite practical to keep the system running by exchanging auxiliary batteries at intervals dictated by the power drain on the system.

The power cable from the auxiliary battery is fused (2A) within the PVC pipe itself to prevent damage to the battery or the logger in case of a short circuit in the system.

B.2.4 Solar Panel

In order to keep the PAQMOS-26m running indefinitely without the bother of frequent replacements of auxiliary batteries, the system normally includes a Solarex SX-5 solar panel. Under most conditions (*i.e.*, excluding the high latitudes in winter conditions) the output of this panel is sufficient to keep a fully instrumented tower (5 wind speeds and 4 differential temperatures) operational full time with reserve power for other measurement devices. If in doubt, it is not difficult to calculate the average daily output by the solar panel for any location with enough climate information (average direct and diffuse solar radiation amounts) and to decide whether there will be adequate energy produced to supply the known demand of the PAQMOS-26m. This balance will depend, of course, on what instrumentation is mounted on the tower.

The solar panel does not have a 12V battery charging circuit associated with it since the logger has an excellent internal charging circuit. Therefore the solar panel is plugged directly into the logger and charges the logger's internal battery. It is fortunate that the logger's charging circuit is designed in such a way that the external battery is also charged with a regulated voltage. Thus, charging with the solar panel is extremely simple and effective.

The solar panel is mounted vertically on the lowest section of the tower. Generally, the higher up it can be installed, the better. It is felt that the vertical orientation is a good compromise between energy collected, ease of installation and keeping the solar panel clean. This is particularly true in winter when snow can collect on an inclined panel. If necessary, the panel can be inclined (using a modified mount) so that the energy collection is increased. In the horizontal plane, the panel is oriented so that the collecting surface is pointed directly south. If there is something (a hill, building, *etc.*) which would obscure the panel for part of the day, it might be necessary to choose another orientation - one which would maximize the amount of sunlight falling on the collector surface.

B.2.5 Gill 3-cup Anemometers

The 3-cup anemometers used on the PAQMOS-26m are manufactured by R.M. Young. They are Gill anemometers, model 12102. An internal tachometer generator, mounted on the cup shaft generates a DC voltage which is proportional to the rate of revolution of the cups which, in turn, is proportional to the wind speed. The datalogger measures the DC voltage and converts it to wind speed.

The anemometers are mounted on boom arms about 50cm from the tower, where wind shadowing effects of the tower itself will be diminished considerably. Standard mounting levels are 1.5, 4, 8, 16 and 26m although these can be adjusted easily.

These anemometers are particularly suitable for the PAQMOS-26m as they draw no power from the system. Note that there is no capability for wind direction measurement with the cup anemometers.

B.2.6 Thermocouples

Temperature differential measurements are made with standard copper/constantan thermocouples mounted in 6-plate, self-ventilating radiation shields manufactured by R.M. Young Co. (model 41001). Thermocouple junctions are placed at the 1.5, 4, 8, 16 and 26m levels, but, like the anemometers, the levels (and numbers) can easily be modified.

The thermocouples are wired up so that temperature measurements are differentials with respect to the 1.5m level. This removes any necessity for constant temperature reference junctions, *etc.*, which would be impossible to maintain at a remote, unattended site. The thermocouples generate a voltage proportional to the difference in temperature at their junctions. The datalogger measures this voltage and converts it to a temperature difference.

If desired, the absolute temperature at the 1.5m level can be obtained using a collocated PAQMOS-10m. (This would also provide the 10m wind direction.)

B.3 SYSTEM ACCURACY

The accuracy of the system as a whole (sensor, interface, datalogger and data transfer) is given in Table 3.

B.4 DATA ACQUISITION PROCEDURES

See Section A.4 of Appendix A for a description of the data acquisition procedures for the PAQMOS system. The discussion there applies equally well to a network of PAQMOS-26m's.

APPENDIX C - WIRING LISTS AND DATALOGGER PROGRAMS

For completeness, this appendix contains wiring lists for the PAQMOS-10m and the PAQMOS-26m. It also lists the PAQMOS-10m and PAQMOS-26m datalogger programs.

Note that the PAQMOS-10m wiring list applies to the post configuration using the Rotronics 8-30VDC(unregulated) T/H sensor - the sensor of choice in any future installations. The corresponding datalogger program (P7PQ) applies also to this T/H sensor. Note that the program listed is generic. To set it up for a particular site, it would be necessary to replace 999 with the site identification number in program step 01:01, replace the wind speed multiplier (.1) and offset (0.0) values with actual calibration values in program steps 03:05 and 03:06 respectively, replace the wind direction offset (0.0) with the correction value determined at installation in program step 04:09 and replace the barometric pressure offset (0.0) with the correction value determined at installation in program step 07:06. Note that the barometric pressure registered by the logger is the actual pressure (in kPa) minus 100.0kPa. This is done to preserve the resolution of the pressure measurement. The 100.0kPa is added back to the pressure measurement in subsequent data processing.

The PAQMOS-26m program is not generic. The site identifier (401, program step 01:01) and the calibration coefficients for the cup anemometers (program steps 05 to 08) have already been inserted into the program. Note that if an anemometer were replaced, the calibration coefficients for that particular level would need to be changed.

CR21X WIRING LIST

20 February 1989

PICKERING MesoNet (P7) - PAQMOS-10m

1H – anemometer,white (direction signal)
1L – anemometer,green (direction common)
1G – anemometer,orange (direction common)
2H – T/H,white (temperature signal)
2L – connect to 2G,black (T/H common)
2G – connect to 2L,black (T/H common)
3H – T/H,green (humidity signal)
3L – connect to 3G,black (T/H common)
3G – connect to 3L,black (T/H common)
4H – barometer,white (signal)
4L – barometer,green (common)
4G – barometer,black (common)
5H –
5L –
5G –
6H –
6L –
6G –
7H –
7L –
7G –
8H –
8L –
8G – connect to ground bar

EX1 – anemometer,red (direction excitation)
EX2 –
EXG –
EX3 –
EX4 –
EXG –
CAO1 –
CAO2 –
CAOG – T/H,black (T/H common)
CTL1 –
CTL2 –
CTL3 –
CTL4 –
CTL5 –
CTL6 –
CTLG –
PLS1 – anemometer,blue,via-filter (speed signal)
PLS2 –
PLSG – anemometer,black,via-filter (speed ground)
PLS3 –
PLS4 –
PLSG –
+12 – connect to +12 bar,red
G –

CR21X WIRING LIST

PICKERING MesoNet (P7) - PAQMOS-10m

G – ground rod,green
G – anemometer shield,yellow
G – T/H shield,clear
G – barometer shield,yellow
G –
G –
G –
G –
G – auxiliary battery,black
G – connect to logger 8G,black

+12 – T/H,red
+12 – barometer,red
+12 –
+12 –
+12 –
+12 –
+12 –
+12 –
+12 –
+12 –
+12 – auxiliary battery,red
+12 – connect to logger +12,red

Anemometer

white 1H
green 1L
orange 1G
red EX1
blue PLS1(via filter)
black PLSG(via filter)
yellow GBar

T/H Sensor

white 2H
green 3H
black CAOG
red +12bar
shield Gbar

Barometer

white 4H
green 4L
black 4G
red +12bar
yellow Gbar

Solar Panel

charging input

Ground Rod

green Gbar

Jumpers

2L - 2G
3L - 3G
8G - Gbar
+12 - +12bar

Auxiliary Battery
red +12bar
black Gbar

CR21X WIRING LIST

20 February 1989

PICKERING MesoNet (P7) - PAQMOS-26m

1H – thermocouple-4m,Cu
1L – thermocouple-1.5m,Cu : connect to 2L+3L+4L
1G –
2H – thermocouple-8m,Cu
2L – connect to 1L+3L+4L
2G –
3H – thermocouple-16m,Cu
3L – connect to 1L+2L+4L
3G – anemometer-1.5m,red (ground)
4H – thermocouple-26m,Cu
4L – connect to 1L+2L+3L
4G – anemometer-4m,red (ground)
5H – anemometer-1.5m,black (signal)
5L – anemometer-4m,black (signal)
5G – anemometer-8m,red (ground)
6H – anemometer-8m,black (signal)
6L – anemometer-16m,black (signal)
6G – anemometer-16m,red (ground)
7H – anemometer-26m,black (signal)
7L –
7G – anemometer-26m,red (ground)
8H –
8L –
8G – connect to ground bar,black

N.B. All Co's twisted (not soldered) together in Marr connector inside logger enclosure.

EX1 –
EX2 –
EXG –
EX3 –
EX4 –
EXG –
CAO1 –
CAO2 –
CAOG –
CTL1 –
CTL2 –
CTL3 –
CTL4 –
CTL5 –
CTL6 –
CTLG –
PLS1 –
PLS2 –
PLSG –
PLS3 –
PLS4 –
PLSG –
+12 – connect to +12 bar,red
G –

CR21X WIRING LIST

PICKERING MesoNet (P7) - PAQMOS-26m

G – ground rod,green
G – anemometer-1.5m,shield
G – anemometer-4m,shield
G – anemometer-8m,shield
G – anemometer-16m,shield
G – anemometer-26m,shield
G –
G –
G – auxiliary battery,black
G – connect to logger 8G,black

+12 –
+12 –
+12 –
+12 –
+12 –
+12 –
+12 –
+12 –
+12 –
+12 –
+12 – auxiliary battery,red
+12 – connect to logger +12,red

Anemometers

(As above)

Thermocouples

(As above)

N.B. All Co's twisted (not soldered) together with a Marr connector inside logger enclosure.

Solar Panel

charging input

Ground Rod

green Gbar

Jumpers

1L - 2L - 3L - 4L
8G - Gbar
+12 - +12bar

Auxiliary Battery

red +12bar
black Gbar

```
Program: P7PQ
Flag Usage:
  none
Input Channel Usage:
  1d-direction
  2d-temperature
  3d-humidity
  4d-barometric pressure
Excitation Channel Usage:
  1-direction
Continuous Analog Output Usage:
  none
Control Port Usage:
  none
Pulse Input Channel Usage:
  1-wind speed
12V Continuous Usage:
  1-auxiliary battery
  2-barometric pressure
  3-T/H - Rotronics 8-35VDC (unreg)
Charging Input:
  1-solar panel
Input location definitions:
  1-post #
  2-battery voltage (V)
  3-wind speed (m/s)
  4-wind direction (deg)
  5-temperature (C)
  6-humidity (%)
  7-barometric pressure -100.0 (kPa)
  18-std.dev. wind speed (m/s)
Output Array Definitions:
       Table 1 (10-min averages)
  1-table #, instruction
  2-Julian day
  3-hrmn
  4-post #
  5-mean wind speed (m/s)
  6-mean wind vector (m/s)
  7-mean wind vector direction (deg)
  8-std.dev. direction (deg)
  9-std.dev. wind speed (m/s)
  10-maximum wind speed (m/s)
  11-mean temperature (C)
  12-mean humidity (%)
  13-mean barometric pressure -100.0 (kPa)
Output Array Definitions:
       Table 2 (240-min averages)
  1-table#, instruction
  2-year
  3-Julian Day
  4-hrmn
  5-minimum battery voltage (V)
  6-average battery voltage (V)
  7-maximum battery voltage (V)


*     1       Table 1 Programs
  01: 1.0     Sec. Execution Interval
```

```
01:  P30          Z=F Write post # to Inloc.1
  01: 999         F Post #
  02: 1           Z Loc [:Post.No. ]

02:  P10          Battery Voltage
  01: 2           Loc [:Batt.V.  ]

03:  P3           Pulse Wind Speed
  01: 1           Rep
  02: 1           Pulse Input Chan
  03: 11          Low level AC
  04: 3           Loc [:W.Speed  ]
  05: .1          Mult
  06: 0.0         Offset

04:  P8           Excite,Delay,Volt(DIFF) Wind Direction
  01: 1           Rep
  02: 4           500 mV slow Range
  03: 1           IN Chan
  04: 1           Excite all reps w/EXchan 1
  05: 2           Delay (units=.01sec)
  06: 355         mV Excitation
  07: 4           Loc [:W.Dir.   ]
  08: 1.0         Mult
  09: 0.0         Offset

05:  P2           Volt (DIFF) Temperature
  01: 1           Rep
  02: 4           500 mV slow Range
  03: 2           IN Chan
  04: 5           Loc [:Temp.    ]
  05: .1          Mult
  06: 0.0000      Offset

06:  P2           Volt (DIFF) Humidity
  01: 1           Rep
  02: 5           5000 mV slow Range
  03: 3           IN Chan
  04: 6           Loc [:Hum.     ]
  05: .1          Mult
  06: 0.0000      Offset

07:  P2           Volt (DIFF) Bar.Press.
  01: 1           Rep
  02: 5           5000 mV slow Range
  03: 4           IN Chan
  04: 7           Loc [:Bar.Prs. ]
  05: .02032      Mult
  06: 0.0         Offset

08:  P92          If time is
  01: 0           minutes into a
  02: 10          minute interval
  03: 10          Set flag 0 (output)

09:  P77          Real Time
  01: 0110        Day,Hour-Minute
```

```
10:  P70        Sample Post #
  01: 1         Rep
  02: 1         Loc Post.No.

11:  P76        Wind Vector
  01: 1         Rep
  02: 0         Polar Sensor (speed and direc)
  03: 3         Wind Speed/East Loc W.Speed
  04: 4         Wind Direction/North Loc W.Dir.

12:  P52        Standard Deviation of Wind Speed
  01: 1         Rep
  02: 3         Sample Loc W.Speed
  03: 18        SD Loc [:SD-W.Spd.]
  04: 666       No. of Samples

13:  P70        Sample Standard Deviation of Wind Speed
  01: 1         Rep
  02: 18        Loc SD-W.Spd.

14:  P73        Maximize Wind Speed
  01: 1         Rep
  02: 0         Value only
  03: 3         Loc W.Speed

15:  P71        Average Temperature, Humidity, Bar. Press.
  01: 3         Reps
  02: 5         Loc Temp.

16:  P          End Table 1


*      2        Table 2 Programs
  01: 60        Sec. Execution Interval

01:  P10        Battery Voltage
  01: 2         Loc [:Batt.V.  ]

02:  P92        If time is
  01: 0         minutes into a
  02: 240       minute interval
  03: 10        Set flag 0 (output)

03:  P80        Year

04:  P77        Real Time
  01: 110       Day,Hour-Minute

05:  P74        Minimize
  01: 1         Rep
  02: 0         Value only
  03: 2         Loc Batt.V.

06:  P71        Average
  01: 1         Rep
  02: 2         Loc Batt.V.
```

```
07:  P73        Maximize
  01: 1         Rep
  02: 0         Value only
  03: 2         Loc Batt.V.

08:  P          End Table 2


*     3         Table 3 Subroutines

01:  P          End Table 3


*     4         Mode 4 Output Options
  01: 00        Tape/Printer Option
  02: 00        Printer Baud Option


*     A         Mode 10 Memory Allocation
  01: 28        Input Locations
  02: 64        Intermediate Locations


*     C         Mode 12 Security
  01: 00        Security Option
  02: 0000      Security Code
```

```
Program: P7TV
Flag Usage:
  None
Input Channel Usage:
  1d - (T4-T1.5)
  2d - (T8-T1.5)
  3d - (T16-T1.5)
  4d - (T26-T1.5)
  9s - G3C1.5m
  10s - G3C4m
  11s - G3C8m
  12s - G3C16m
  13s - G3C26m
Excitation Channel Usage:
  None
Continuous Analog Output Usage:
  None
Control Port Usage:
  None
Pulse Input Channel Usage:
  None
12V Continuous Usage:
  1 - Auxiliary battery
Charging Input:
  1 - Solar Panel
Input Location Usage:
  1 - Tower Identifier (401)
  2 - Battery Voltage (V)
  3 - DeltaT 4-1.5 (C)
  4 - DeltaT 8-1.5 (C)
  5 - DeltaT 16-1.5 (C)
  6 - DeltaT 26-1.5 (C)
  7 - G3C Speed 1.5m (m/s)
  8 - G3C Speed 4m (m/s)
  9 - G3C Speed 8m (m/s)
  10 - G3C Speed 16m (m/s)
  11 - G3C Speed 26m (m/s)
  12 - G3C Sp.Var. 1.5m (m/s)
  13 - G3C Sp.Var. 4m (m/s)
  14 - G3C Sp.Var. 8m (m/s)
  15 - G3C Sp.Var. 16m (m/s)
  16 - G3C Sp.Var. 26m (m/s)
Output Array Definitions:
       Table 1 (10-min averages)
  1 - Table No.
  2 - Julian Day
  3 - HRMN
  4 - Tower Identifier (401)
  5 - DeltaT 4-1.5 (C)
  6 - DeltaT 8-1.5 (C)
  7 - DeltaT 16-1.5 (C)
  8 - DeltaT 26-1.5 (C)
  9 - G3C Speed 1.5m (m/s)
  10 - G3C Speed 4m (m/s)
  11 - G3C Speed 8m (m/s)
  12 - G3C Speed 16m (m/s)
  13 - G3C Speed 26m (m/s)
  14 - G3C Sp.Var. 1.5m (m/s)
  15 - G3C Sp.Var. 4m (m/s)
```

```
  16 - G3C Sp.Var. 8m (m/s)
  17 - G3C Sp.Var. 16m (m/s)
  18 - G3C Sp.Var. 26m (m/s)
       Table 2 (240-min averages)
  1 - Table No.
  2 - Year
  3 - Julian Day
  4 - HRMN
  5 - Minimum Battery Voltage (V)
  6 - Average Battery Voltage (V)
  7 - Maximum Battery Voltage (V)


*     1         Table 1 Programs
  01: 1.0       Sec. Execution Interval

01:  P30        Z=F
  01: 401       F
  02: 1         Z Loc [:Post.No. ]

02:  P10        Battery Voltage
  01: 2         Loc [:Batt.Volt]

03:  P2         Volt (DIFF) DeltaT's
  01: 4         Reps
  02: 1         5 mV slow Range
  03: 1         IN Chan
  04: 3         Loc [:DeltaT    ]
  05: 25.227    Mult
  06: 0.0000    Offset

04:  P1         Volt (SE) G3C 1.5m
  01: 1         Rep
  02: 5         5000 mV slow Range
  03: 9         IN Chan
  04: 7         Loc [:WSp-1.5m ]
  05: .01234    Mult
  06: .29       Offset

05:  P1         Volt (SE) G3C 4m
  01: 1         Rep
  02: 5         5000 mV slow Range
  03: 10        IN Chan
  04: 8         Loc [:WSp-4m    ]
  05: .01238    Mult
  06: .26       Offset

06:  P1         Volt (SE) G3C 8m
  01: 1         Rep
  02: 5         5000 mV slow Range
  03: 11        IN Chan
  04: 9         Loc [:WSp-8m    ]
  05: .01243    Mult
  06: .27       Offset
```

```
07:  P1          Volt (SE) G3C 16m
  01: 1          Rep
  02: 5          5000 mV slow Range
  03: 12         IN Chan
  04: 10         Loc [:WSp-16m  ]
  05: .01232     Mult
  06: .32        Offset

08:  P1          Volt (SE) G3C 26m
  01: 1          Rep
  02: 5          5000 mV slow Range
  03: 13         IN Chan
  04: 11         Loc [:WSp-26m  ]
  05: .01245     Mult
  06: .31        Offset

09:  P92         If time is
  01: 0          minutes into a
  02: 10         minute interval
  03: 10         Set flag 0 (output)

10:  P77         Real Time
  01: 0110       Day,Hour-Minute

11:  P70         Sample
  01: 1          Rep
  02: 1          Loc Post.No.

12:  P71         Average
  01: 9          Reps
  02: 3          Loc DeltaT

13:  P52         Standard Deviation
  01: 5          Reps
  02: 7          Sample Loc WSp-1.5m
  03: 12         SD Loc [:S.D.-WSp ]
  04: 666        No. of Samples

14:  P70         Sample
  01: 5          Reps
  02: 12         Loc S.D.-WSp

15:  P           End Table 1


*     2          Table 2 Programs
  01: 60         Sec. Execution Interval

01:  P10         Battery Voltage
  01: 2          Loc [:Batt.Volt]

02:  P92         If time is
  01: 0          minutes into a
  02: 240        minute interval
  03: 10         Set flag 0 (output)

03:  P80         Year
```

```
04:  P77        Real Time
  01: 110       Day,Hour-Minute

05:  P74        Minimize
  01: 1         Rep
  02: 0         Value only
  03: 2         Loc Batt.Volt

06:  P71        Average
  01: 1         Rep
  02: 2         Loc Batt.Volt

07:  P73        Maximize
  01: 1         Rep
  02: 0         Value only
  03: 2         Loc Batt.Volt

08:  P          End Table 2


*     3         Table 3 Subroutines

01:  P          End Table 3


*     4         Mode 4 Output Options
  01: 00        Tape/Printer Option
  02: 00        Printer Baud Option


*     A         Mode 10 Memory Allocation
  01: 28        Input Locations
  02: 64        Intermediate Locations


*     C         Mode 12 Security
  01: 00        Security Option
  02: 0000      Security Code
```

APPENDIX D - SURFACE WEATHER DATA ACQUISITION

A paper presented at the 1987 AES Workshop on Environmental Emergency Response, 'Surface Weather Data Acquisition Near Potential Accident Locations' by Peter A. Taylor, is reproduced on the following pages.

Surface Weather Data Acquisition near Potential Accident Locations

Peter A. Taylor
Boundary Layer Research Division

As a part of its contribution to the 1986 Canadian Atlantic Storms Program, The Boundary Layer Research Division of AES developed mesoscale networks of portable automated surface weather stations (see Fig 1). These PAMs (Portable Automated Mesonets) were utilized Jan-March 1986 in the Halifax area (17 stations) and on Sable Island (9 stations) and, in their first full scale deployment, performed extremely well (~ 99% data recovery except for the Temperature/Humidity sensors) in severe conditions. Some of these stations are now operating at lakeside locations in Southern Ontario as a part of the AES monitoring program in connection with high water levels in the Great Lakes while two similar stations have been installed at Canada Olympic Park in Calgary for wind speed and temperature monitoring.

The stations utilise commercially available sensors and data loggers (Campbell CR 21X Microloggers), are automated, robust and can operate without an AC mains power supply using batteries and a small solar panel. The stations can process and store data and can be interrogated remotely via radio-telemetry or telephone. Data can also be transferred at the site to a portable 'lap-top' computer or other device (e.g a cassette tape recorder). An extensive suite of computer software for processing, quality control and display of data has been developed.

It is in our view that these or similar stations could form the basis for relatively inexpensive and reliable surface wind and weather monitoring networks in the vicinity of nulclear power plants, large chemical complexes or other major fixed sites with the potential for accidental release of hazardous substances.

The CASP-PAM stations each utilized CR21X Microloggers (~ $4K), R.M. Young Wind Monitors (~ $1K), Met One Temperature/Humidity and Pressure Sensors (~ $2K, ~ $1K) and Standard Belfort Weighing Precipitation Gauges (~ $1.5K). A 10m tower, batteries and Solar panel at a combined cost of $1K

brought the total to about $10.5K per station. Use of a smaller data logger (eg the CR10), cheaper (and better) T/H instruments and perhaps omitting pressure sensors and precipitation gauges could bring the equipment cost down to ~ $5.5K per station or, for wind & direction only, to $4K / station. Data transmission costs are ~ $3K / tower for radio telemetry but less (~ $1K) if telephone lines are available. There will of course be additional costs for installation, maintenance and the base station but a network of stations could still be installed and operated at quite modest cost, say $200K + $20K per annum for 12 stations.(see Fig 2)

The CR21X and other comparable, commercially available data loggers have considerable flexibility and can be programmed to accept data from a wide range of sensors. Simple air quality or radio activity monitors with suitable analogue outputs could, if available, be added to the stations. Taller (26m) towers could also be used if needed at only a slight (~ $1K) additional cost. Several groups within AES (e.g. Boundary-Layer Research Division, Hydrometeorology Division, Ontario Region) now have experience with this type of station and the associated data acquisition, processing and display. In addition a number of Canadian meteorological consultants and consulting companies have the expertise to install and operate them. Reliable networks of this type are now available. They have the capacity to provide both climatological data for environmental impact assessment and safety analyses and on-line, real-time, computer - compatible data should a hazardous release occur.

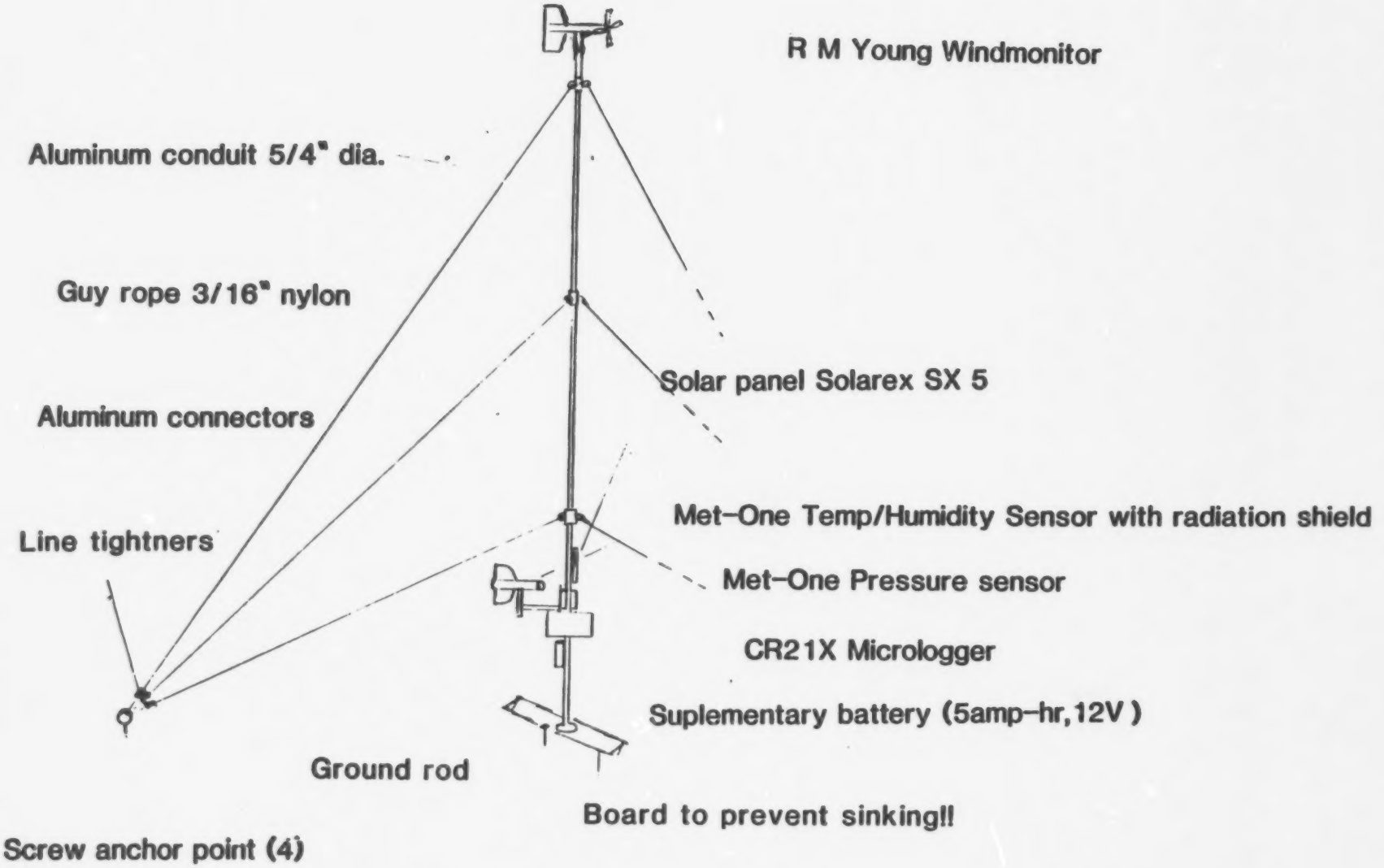
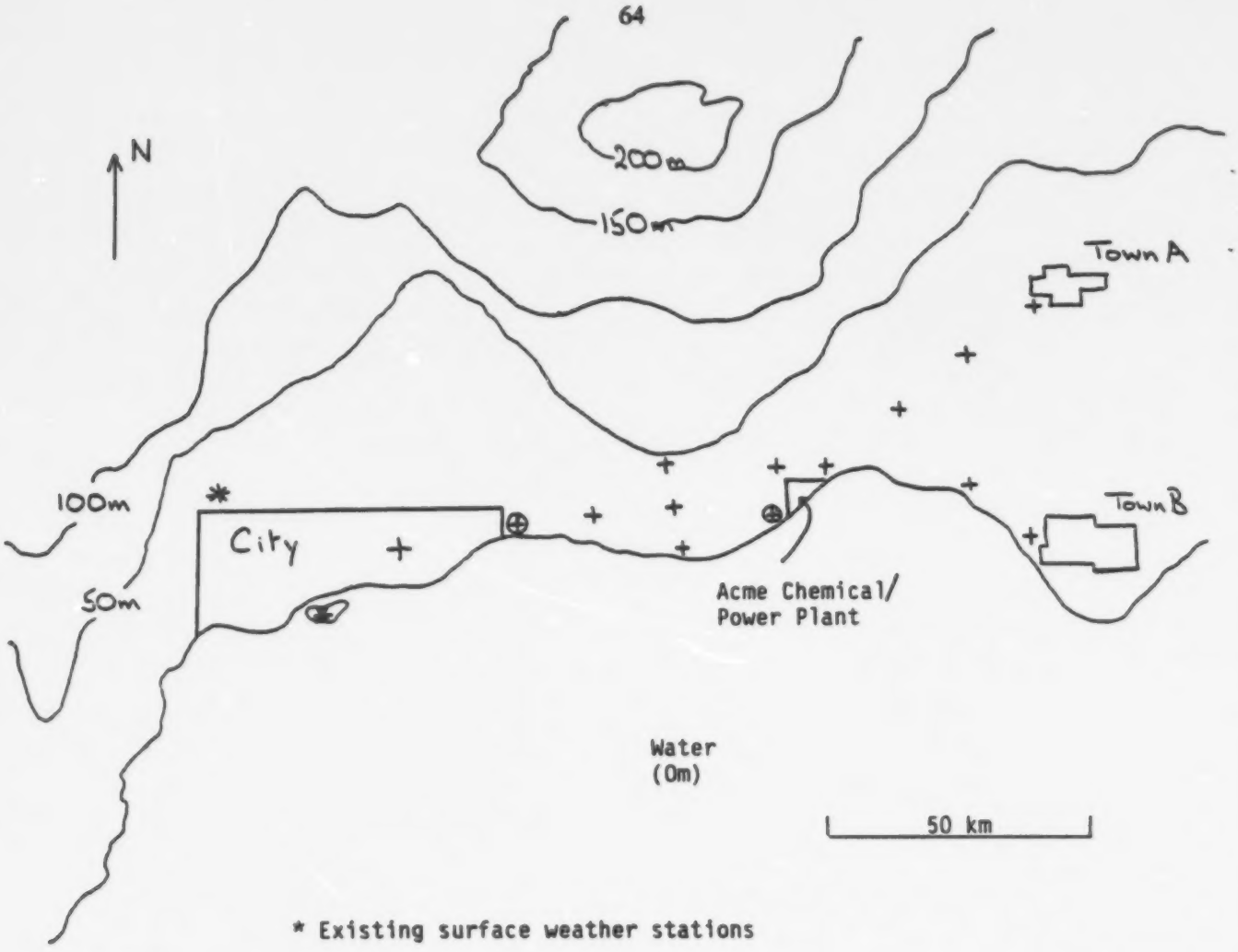


Figure 1 CASP'86 10m MESONET POST



* Existing surface weather stations

Suggested extra stations

● Tall towers (> 10m) ,2

\+ 10m stations , 12

Estimated cost : $200K + $20K/annum

Population ~ 2 million, 10¢/head + 1c/head/annum.

Figure 2. Schematic diagram of possible network of Surface weather stations.

Table 1. Units, sampling level (above the base of the post) and instrument accuracy for the meteorological measurements made with the Pickering MesoNet PAQMOS-10m's. The measurements were made at 1s intervals and averaged over 10min periods.

Parameter	Units	Level	Accuracy
Wind Speed	m/s	10m	±0.2m/s
Wind Direction	°true	10m	±10°
Temperature	°C	1.5m	±0.3 to 1.0°C*
Humidity	%	1.5m	±5%
Barometric Pressure	kPa	1.5m	±0.02kPa

*depends on ambient wind speed and insolation.

Table 2. Tabulation of some of the data contained in the master data file for the PAQMOS-10m's in the Pickering MesoNet.

```
TowerNet Summary
----------------
Pickering NGS 87/88/89 Met. Study - PAQMOS

TowerNet name: p7pq
TowerNet data starts: 1988 001JD      1988 January  1
      ends: 1989 365JD      1989 December 31
Data interval: 10min

Tower Locations  Xref=   50000.m  Yref=   50000.m  Zref=   0.0m
---------------
No. Short ID Long ID                          X(m)       Y(m)    Alt.(m)
  1 CHERRYWD Cherrywood                     -700.0     6700.0      152.0
  2 PICKERNG Pickering N.G.S.               6000.0     2300.0       76.0
  3 GRNWOOD  Greenwood Cons. Area           5800.0    12300.0      130.0
  4 CLAREMNT Claremont                      -200.0    18300.0      248.0
  5 EASTPNT  East Point - M.C.T.P.          -800.0    -2300.0       85.0
  6 SCARB    Scarborough                  -10900.0    -4700.0      170.0
  7 SCICENTR Ontario Science Centre       -16200.0    -8500.0      120.0
  8 AJAX     Ajax - Audley Road            10400.0    10900.0      110.0
  9 OSHAWA   Oshawa Airport                18400.0    15700.0      145.0
 10 UNUSED   Unused                      -50000.0   -50000.0        0.0

Data Parameters
---------------
No. Dim Short ID Long ID                                 Units    Elev.(m)
  1   1 SSPD     Scalar Wind Speed at 10m                m/s         10.00
  2   1 SGSSPD   Std.Dev. of Scalar Wind Speed           m/s         10.00
  3   1 MXSSPD   Maximum Scalar Wind Speed              m/s         10.00
  4   2 VSPD     Vector Wind Speed at 10m                m/s         10.00
  5   2 DIR      Wind Direction                          degt        10.00
  6   1 SGDIR    Std.Dev. of Wind Direction              deg         10.00
  7   1 TEMP     Air Temperature                         C            1.50
  8   1 NUM      Humidity                                %            1.50
  9   1 BPRES    Barometric Pressure                     kPa          1.50

No. Short ID   LOcutoff   HIcutoff
  1 SSPD     0.0000E+00 0.5000E+02
  2 SGSSPD   0.0000E+00 0.1000E+02
  3 MXSSPD   0.0000E+00 0.8000E+02
  4 VSPD     0.0000E+00 0.5000E+02
  5 DIR      0.0000E+00 0.3600E+03
  6 SGDIR    0.0000E+00 0.1800E+03
  7 TEMP     -.4000E+02 0.4000E+02
  8 NUM      0.1000E+02 0.1400E+03
  9 BPRES    0.9000E+02 0.1100E+03
```

Table 3. Units, sampling level (above the base of the post) and instrument accuracy for the meteorological measurements made with the Pickering MesoNet PAQMOS-26m. The measurements were made at 1s intervals and averaged over 10min periods.

Parameter	Units	Level	Accuracy
Wind Speed	m/s	1.5m 4m 8m 16m 26m	±0.2m/s
Temperature Differential	°C	4-1.5m 8-1.5m 16-1.5m 26-1.5m	±0.1°C*

*may depend on ambient wind speed and insolation.

Table 4. Tabulation of some of the data contained in the master data file for the PAQMOS-26m in the Pickering MesoNet at Cherrywood.

```
TowerNet Summary
----------------
Pickering NGS 87/88/89 Met. Study - TallTower (w.variance)

TowerNet name: P7TV
TowerNet data starts: 1988 016JD      1988 January 16
      ends: 1989 365JD      1989 December 31
Data interval: 10min

Tower Locations  Xref=   50000.m  Yref=   50000.m  Zref=   0.0m
---------------
No. Short ID Long ID                          X(m)       Y(m)    Alt.(m)
  1 CHERRYTV Cherrywood TallTower (w.v.) -700.0     6700.0      152.0

Data Parameters
---------------
No. Dim Short ID Long ID                                  Units     Elev.(m)
  1   1 SSPD1.5  Wind Speed at 1.5m                       m/s           1.50
  2   1 SSPD4    Wind Speed at 4m                         m/s           4.00
  3   1 SSPD8    Wind Speed at 8m                         m/s           8.00
  4   1 SSPD16   Wind Speed at 16m                        m/s          16.00
  5   1 SSPD26   Wind Speed at 26m                        m/s          26.00
  6   1 SGSPD1.5 Wind Speed Var. at 1.5m                  m/s           1.50
  7   1 SGSPD4   Wind Speed Var. at 4m                    m/s           4.00
  8   1 SGSPD8   Wind Speed Var. at 8m                    m/s           8.00
  9   1 SGSPD16  Wind Speed Var. at 16m                   m/s          16.00
 10   1 SGSPD26  Wind Speed Var. at 4t 26m                m/s          26.00
 11   1 DT 4-1.5 Delta Air Temp. 4-1.5m                   C             4.00
 12   1 DT 8-1.5 Delta Air Temp. 8-1.5m                   C             8.00
 13   1 DT16-1.5 Delta Air Temp. 16-1.5m                  C            16.00
 14   1 DT26-1.5 Delta Air Temp. 26-1.5m                  C            26.00

  No. Short ID LOcutoff    HIcutoff
  1 SSPD1.5  0.0000E+00 0.5000E+02
  2 SSPD4    0.0000E+00 0.5000E+02
  3 SSPD8    0.0000E+00 0.5000E+02
  4 SSPD16   0.0000E+00 0.5000E+02
  5 SSPD26   0.0000E+00 0.5000E+02
  6 SGSPD1.5 0.0000E+00 0.1000E+02
  7 SGSPD4   0.0000E+00 0.1000E+02
  8 SGSPD8   0.0000E+00 0.1000E+02
  9 SGSPD16  0.0000E+00 0.1000E+02
 10 SGSPD26  0.0000E+00 0.1000E+02
 11 DT 4-1.5 -.5000E+01 0.1000E+02
 12 DT 8-1.5 -.5000E+01 0.1000E+02
 13 DT16-1.5 -.5000E+01 0.1000E+02
 14 DT26-1.5 -.5000E+01 0.1000E+02
```

Table 5a. Climatological Wind Normals (1955-1980) for Toronto (Pearson) International Airport.

TORONTO INT'L A ONT.

PERIOD 1955-80 PERIODE

Lat. 43°40'N Long. 079°38'W

Elevation 173 m Altitude

	JAN JANV	FEB FEV	MAR MARS	APR AVR	MAY MAI	JUN JUIN	JUL JUIL	AUG AOUT	SEP SEPT	OCT OCT	NOV NOV	DEC DEC	YEAR ANNUEL	
PERCENTAGE FREQUENCY														**FREQUENCE EN %**
N	11.2	12.7	12.2	12.0	11.5	11.3	11.2	11.0	11.3	9.9	7.9	10.0	11.0	N
NNE	3.3	3.4	3.5	3.2	2.5	2.5	2.3	2.6	3.2	2.6	2.4	3.5	2.9	NNE
NE	3.2	3.0	3.7	2.3	2.4	1.6	1.5	1.9	2.3	2.5	2.6	3.9	2.6	NE
ENE	2.4	2.5	3.4	3.2	2.5	1.3	1.2	1.3	2.0	2.2	2.7	3.5	2.3	ENE
E	3.0	4.3	6.1	8.2	6.2	3.5	2.4	2.9	4.2	4.8	4.5	3.6	4.6	E
ESE	2.4	2.2	3.4	3.5	3.6	2.9	2.1	2.5	3.4	3.8	3.8	3.2	3.1	ESE
SE	2.0	1.9	3.2	4.7	5.7	5.8	4.9	4.7	5.2	5.2	4.3	2.9	4.2	SE
SSE	1.7	2.0	2.8	4.3	6.9	7.6	6.4	6.4	5.3	4.8	3.5	2.2	4.5	SSE
S	5.0	5.6	4.1	4.5	6.6	8.0	7.9	6.7	6.9	6.5	6.2	5.7	6.1	S
SSW	6.2	5.2	3.7	3.1	3.5	4.7	4.8	4.4	4.9	5.0	5.3	5.4	4.7	SSW
SW	10.7	8.9	5.1	4.8	5.5	6.9	6.9	7.4	6.9	7.7	8.6	9.7	7.3	SW
WSW	13.1	8.2	5.6	4.6	5.0	6.0	6.4	6.7	5.7	7.5	11.0	10.8	7.5	WSW
W	12.2	12.7	11.3	10.1	8.8	9.4	10.7	10.4	10.3	10.8	13.4	11.4	11.0	W
WNW	6.3	7.4	6.6	6.3	7.3	6.8	7.5	7.1	6.5	6.1	7.0	5.9	7.1	WNW
NW	6.0	6.4	7.7	7.9	7.1	7.3	7.8	8.3	6.4	6.5	5.6	5.8	7.1	NW
NNW	7.9	10.1	9.7	11.1	9.9	8.7	9.1	9.4	9.3	8.1	6.4	8.0	9.0	NNW
Calm	3.4	3.5	3.9	4.2	5.0	5.7	6.9	6.3	6.2	6.0	4.8	4.5	5.0	Calme
MEAN WIND SPEED IN KILOMETRES PER HOUR														
VITESSE MOYENNE DES VENTS EN KILOMETRES PAR HEURE														
N	16.7	17.1	15.7	15.8	15.5	14.4	12.8	12.4	12.9	13.3	14.6	16.0	14.8	N
NNE	14.2	15.1	14.0	13.9	12.3	11.7	10.8	11.5	12.4	11.9	12.4	13.5	12.8	NNE
NE	15.2	14.5	14.0	13.6	11.1	9.8	10.3	11.3	9.9	11.2	12.6	14.7	12.4	NE
ENE	18.6	18.1	17.8	17.2	14.8	12.9	12.9	10.9	11.9	14.2	14.7	17.4	15.1	ENE
E	20.1	20.1	21.4	21.2	17.0	14.9	13.1	13.7	14.0	15.6	16.5	19.2	17.2	E
ESE	17.9	16.5	17.5	16.2	14.4	13.1	12.9	12.8	13.3	14.6	15.8	17.8	15.2	ESE
SE	13.9	12.3	11.9	13.3	12.4	12.4	12.5	12.3	11.9	12.3	12.5	13.3	12.6	SE
SSE	12.7	11.8	12.0	13.6	12.8	12.5	12.9	12.6	11.8	11.9	12.2	11.2	12.3	SSE
S	14.0	13.0	11.7	12.3	11.9	11.0	11.5	11.2	12.0	12.1	13.8	13.0	12.3	S
SSW	17.4	16.7	16.9	17.3	15.1	13.8	13.2	12.9	15.3	15.6	17.1	15.6	15.6	SSW
SW	19.9	17.1	20.5	20.0	17.7	15.7	14.6	14.6	16.1	16.7	19.8	19.0	17.6	SW
WSW	23.2	20.6	20.2	20.5	17.8	16.1	14.5	14.4	15.3	16.9	21.5	21.1	18.5	WSW
W	21.2	20.8	20.8	20.3	17.8	15.7	14.5	13.4	15.1	16.9	20.3	20.8	18.1	W
WNW	23.0	21.1	22.2	22.0	20.1	16.8	15.9	15.1	16.3	18.2	20.7	20.8	19.4	WNW
NW	19.1	20.2	20.2	19.3	16.6	14.8	13.6	13.2	14.4	15.7	18.1	18.2	17.0	NW
NNW	18.1	19.6	19.6	20.0	16.8	15.5	13.6	13.1	14.2	15.5	18.0	19.3	17.0	NNW
All Directions														**Toutes directions**
	18.4	17.6	17.6	17.3	14.9	13.4	12.5	12.3	13.0	14.1	16.6	17.0	15.4	
Maximum Hourly Speed														**Vitesse horaire maximale**
	77 WSW	77 NNW	97 SW	81 W	71 WSW	63 NW	61 E	71 WNW	88 SW	61 W	80 SVL	70 NNW	97 SW	
Maximum Gust Speed														**Vitesse maximale des rafales**
	115 E	97 SVL	124 SW	111 W	88 SW	102 NW	89 WSW	93 WSW	92 SW	96 WNW	97 SSW	95 W	124 SW	

Height of anemometer 10.1 m **hauteur de l'anémomètre**

STATION INFORMATION

Station is located on the slightly rolling to flat terrain. Nearby to the west is a small valley containing the Etobicoke Creek. Most of surrounding countryside is open on which occasional trees are found. The shore of Lake Ontario is about 10 km southeast and main metropolitan area is several km east.

DONNÉES RELATIVES À LA STATION

La station se trouve sur un terrain plat un légrement accidenté. À l'ouest, tout près, un vallon conduit à Etobicoke Creek. La majeure partie de la région environnante est dégagée et ne porte qui quelques arbres. La rive du lac Ontario commence à 10 km au sud-est et le coeur de la ville, à plusieurs km à l'est.

Table 5b. Climatological Wind Normals (1957-1980) for Toronto Island Airport.

TORONTO ISLAND A ONT.

PERIOD 1957-80 PERIODE

Lat. 43°38'N Long. 079°24'W

Elevation 77 m Altitude

	JAN JANV	FEB FEV	MAR MARS	APR AVR	MAY MAI	JUN JUIN	JUL JUIL	AUG AOUT	SEP SEPT	OCT OCT	NOV NOV	DEC DEC	YEAR ANNUEL	
PERCENTAGE FREQUENCY													**FREQUENCE EN %**	
N	5.9	9.2	4.4	7.2	6.4	6.7	6.1	6.2	6.7	6.0	4.8	6.7	6.4	N
NNE	2.5	3.6	1.7	2.3	1.6	1.3	1.5	1.8	2.2	2.0	1.5	3.2	2.1	NNE
NE	3.3	3.3	1.8	1.6	0.7	0.8	0.5	1.3	1.9	1.4	1.5	2.4	1.7	NE
ENE	4.4	3.7	5.5	6.4	5.5	2.4	1.4	3.0	3.7	5.4	4.2	5.8	4.3	ENE
E	7.3	9.8	21.9	18.5	22.1	21.5	13.1	14.4	14.4	14.7	14.3	8.2	15.0	E
ESE	1.9	1.8	3.5	1.5	4.8	4.8	2.9	4.5	4.4	4.9	4.3	4.2	3.6	ESE
SE	1.2	0.9	0.9	0.6	0.8	1.2	1.4	2.2	1.9	1.9	1.6	2.3	1.4	SE
SSE	0.7	0.8	1.0	1.2	1.7	2.0	2.3	3.2	2.6	1.8	1.3	1.6	1.7	SSE
S	1.3	1.7	2.7	4.9	5.8	8.3	10.7	9.3	7.2	4.6	2.6	1.9	5.1	S
SSW	2.4	3.0	4.1	4.2	4.6	6.6	7.7	8.2	5.4	4.7	4.0	2.7	4.8	SSW
SW	6.3	6.5	5.0	4.5	4.9	5.6	7.5	7.0	5.6	5.9	6.5	6.4	6.0	SW
WSW	15.6	9.3	6.2	5.3	5.6	6.8	9.6	6.9	6.7	7.8	11.7	12.9	8.7	WSW
W	24.5	18.4	14.3	10.8	10.0	8.0	10.6	9.7	10.3	14.2	20.1	19.8	14.2	W
WNW	8.1	6.3	6.6	6.1	5.3	4.4	4.4	4.6	5.8	6.4	7.0	7.2	6.4	WNW
NW	6.1	7.5	7.0	7.3	5.6	5.6	6.0	5.6	6.0	6.2	5.4	5.6	6.2	NW
NNW	6.7	10.6	8.1	12.2	6.7	6.6	6.6	5.4	6.7	7.3	6.3	7.0	7.7	NNW
Calm	1.6	1.4	3.1	5.4	7.7	7.2	7.5	6.7	6.5	4.6	2.9	2.1	4.7	Calme
MEAN WIND SPEED IN KILOMETRES PER HOUR														
VITESSE MOYENNE DES VENTS EN KILOMÈTRES PAR HEURE														
N	18.6	19.0	19.2	19.7	18.3	16.7	15.9	13.6	14.9	17.4	19.7	19.1	17.7	N
NNE	16.8	17.1	16.9	18.3	17.8	15.4	16.5	12.9	15.2	14.2	17.7	18.1	16.4	NNE
NE	22.1	18.9	20.5	20.4	16.5	12.6	13.7	12.1	13.3	17.5	18.3	20.0	17.2	NE
ENE	24.2	21.2	22.6	25.0	22.4	14.1	12.2	14.3	16.6	18.8	20.5	22.2	19.5	ENE
E	22.9	23.9	23.8	23.6	18.9	17.1	15.2	15.7	18.3	19.3	20.8	21.8	20.1	E
ESE	19.4	14.2	20.4	15.2	14.0	12.6	11.0	11.5	14.8	18.1	17.9	20.6	15.7	ESE
SE	15.6	9.6	11.1	13.0	9.4	9.6	10.3	10.4	13.1	12.2	16.8	15.7	12.2	SE
SSE	13.1	9.2	11.0	11.9	11.5	9.1	10.2	11.4	10.8	12.6	12.7	12.9	11.4	SSE
S	18.9	12.1	12.3	13.4	12.1	12.3	12.9	12.5	13.8	15.6	15.1	16.7	14.0	S
SSW	24.0	17.9	16.4	15.8	13.4	14.5	13.0	14.3	15.2	19.3	19.2	22.8	17.2	SSW
SW	29.9	24.8	20.5	17.6	13.0	12.4	12.3	13.7	14.6	18.5	24.2	28.8	19.2	SW
WSW	31.3	25.1	21.3	16.6	11.1	10.3	10.6	10.5	13.4	19.0	26.5	28.6	18.7	WSW
W	25.6	22.7	22.3	21.6	17.1	14.7	12.0	12.9	16.3	20.8	24.7	25.1	19.7	W
WNW	21.4	20.1	23.9	23.6	21.7	18.4	15.7	15.9	18.4	20.9	22.1	20.3	20.2	WNW
NW	21.0	19.7	25.6	22.1	19.9	19.2	17.0	14.7	17.3	19.2	19.9	20.8	19.7	NW
NNW	18.2	19.2	22.9	21.5	17.8	18.6	16.2	14.3	15.8	17.9	20.1	21.0	18.6	NNW
All Directions													**Toutes directions**	
	23.8	20.6	21.2	19.6	15.7	14.0	12.6	12.6	14.7	17.7	21.2	22.4	18.0	
Maximum Hourly Speed													**Vitesse horaire maximale**	
	96 SW	61 WSW	65 SVL	78 W	59 WNW	52 SVL	69 NW	41 W	56 E	69 WSW	71 WSW	65 W	96 SW	
Maximum Gust Speed													**Vitesse maximale des rafales**	
	126 SW	101 SW	108 WNW	107 W	91 WNW	93 NNW	100 W	97 WNW	104 NW	97 NW	93 SW	107 WSW	126 SW	

Height of anemometer 11.6 m **Hauteur de l'anémomètre**

STATION INFORMATION

Located at the northwestern end of Toronto Island. The anemometer is located on the lighthouse at the west entrance to the western gap and is well exposed. Buildings are situated 0.8 km north-east and east. The city core is 2.5 km north-east of site.

DONNÉES RELATIVES À LA STATION

Situé à l'extrémité nord-ouest de l'île de Toronto. L'anémomètre se trouve sur l'édifice de l'administration. Son exposition au sud est bonne, mais des hangar au nord-ouest et un édifice au nord-est présentent un certain obstacle au vents. On remarque également des édifices à 0.4 km à l'est-nord-est.

Table 6. Sample output from LOGINQ.LOG.

```
        PROGRAM LOGINQ
        --------------
        Opening serial port.
        Establishing communications.
          Logger:    Year 88    Jday 201    Time  7: 0
        Computer:    Year 88    Jday 201    Time  6:59
        Input Location 1 :  105  (Post #)
        Input Location 2 :  12.639  (Battery, V)
        Input Location 3  :  .855
        Input Location 4  :  242.31
        Input Location 5  :  19.768
        Input Location 6  :  86.338
        Input Location 7  :  .10772
        Input Location 8  :  0
        Input Location 9  :  0
        Input Location 10  :  0
        Input Location 11  :  0
        Input Location 12  :  0
        Resuming logging.
        Station EASTPNT ( 105 ) data will be uploaded now.
        Program LOGINQ done.
EASTPNT/C

7-19-1988 7:1  Datalogger Clock was changed from 7:2
7-19-1988 7:1  Warning: 1 retries were logged.
```

Table 7. Sample printout generated by TNCDA.

```
TNCDA  -  TowerNet CDA-to-Direct File Transfer Program
-------------------------------------------------------
Present Computer Clock Time  -  88/08/02  17:15:05
Pickering NGS 87/88 Met. Study - PAQMOS 1988

----------
Opening P7TEMP\CHERRYWD.DAT
Post #  1    CHERRYWD    Cherrywood
First record ...
110 201 1030  1   1.354       1.205       327.2       26.89
        0.8250      3.125       29.57       53.81     -0.3190
Last record ...
110 211 1640  1   4.112       3.912       295.8       17.86
         1.376      7.600       34.75       34.60      0.2650
 1478 Records processed
    0 Read errors
    0 Table No. errors
    0 Julian day errors
    0 Hour errors
    0 Minute errors
    0 Post No. errors
    0 Non-existent file errors
    0 Attempted overwrite errors
  Out-of-Ranges
    0    1  SSPD      Scalar Wind Speed at 10m
    0    2  SGSSPD    Std.Dev. of Scalar Wind Speed
    0    3  MXSSPD    Maximum Scalar Wind Speed
    0    4  VSPD      Vector Wind Speed at 10m
    0    5  DIR       Wind Direction
    0    6  SGDIR     Std.Dev. of Wind Direction
    0    7  TEMP      Air Temperature
    0    8  HUM       Humidity
    0    9  BPRES     Barometric Pressure

----------
```

Table 8. Yearly averages and data availability summaries from PAQMOS-10m stations.

TowerNet Data Averages

p7pq
Pickering NGS 87/88/89 Met. Study - PAQMOS

Averaging Period - Start 1988 001JD 00:10 1988 January 01 00:10
End 1989 001JD 00:00 1989 January 01 00:00

Averages

PN	ID	SSPD	SGSSPD	MXSSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	3.35	0.81	5.70	1.03	279.	13.4	7.2	72.	99.75
2	PICKERNG	4.23	0.76	6.37	1.27	268.	11.6	9.0	-N/A-	100.68
3	GRNWOOD	2.31	0.77	4.65	0.75	282.	19.0	8.2	-N/A-	100.06
4	CLAREMNT	4.37	0.81	6.66	1.65	293.	10.0	3.9	66.	98.51
5	EASTPNT	4.02	0.85	6.40	1.57	269.	11.9	7.5	72.	100.42
6	SCARB	3.59	0.94	6.24	1.05	271.	14.0	9.5	-N/A-	99.44
7	SCICENTR	2.97	1.02	5.89	1.00	262.	19.9	3.2	68.	99.85
8	AJAX	3.70	0.74	5.76	1.11	269.	11.2	8.1	-N/A-	100.21
9	OSHAWA	3.47	0.73	5.57	1.01	285.	12.5	7.2	72.	99.96

Standard Deviations

PN	ID	SSPD	SGSSPD	MXSSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	1.89	0.51	3.37	-N/A-	-N/A-	6.2	11.5	18.	0.81
2	PICKERNG	2.51	0.45	3.54	-N/A-	-N/A-	6.5	9.9	-N/A-	0.56
3	GRNWOOD	1.45	0.50	3.04	-N/A-	-N/A-	8.1	11.5	-N/A-	0.59
4	CLAREMNT	2.43	0.46	3.63	-N/A-	-N/A-	5.6	11.0	17.	0.85
5	EASTPNT	2.22	0.49	3.50	-N/A-	-N/A-	7.7	10.3	17.	0.90
6	SCARB	2.04	0.47	3.41	-N/A-	-N/A-	5.5	11.0	-N/A-	0.88
7	SCICENTR	1.68	0.58	3.30	-N/A-	-N/A-	7.2	9.0	17.	0.61
8	AJAX	2.29	0.48	3.57	-N/A-	-N/A-	6.3	11.0	-N/A-	0.87
9	OSHAWA	2.01	0.46	3.34	-N/A-	-N/A-	8.1	11.1	17.	0.60

Data Availability (%)

PN	ID	SSPD	SGSSPD	MXSSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	97.8	97.8	97.8	97.8	97.8	97.8	97.8	97.8	83.6
2	PICKERNG	96.7	96.7	96.7	96.7	96.7	96.7	95.1	0.0	96.2
3	GRNWOOD	91.8	91.7	91.8	91.8	91.8	91.8	88.3	0.0	96.1
4	CLAREMNT	44.8	44.8	44.8	44.8	44.8	44.8	47.9	47.9	35.9
5	EASTPNT	98.5	98.5	98.5	98.5	98.5	98.5	98.5	98.5	68.3
6	SCARB	94.6	94.6	94.6	94.6	94.6	94.6	94.6	0.0	54.0
7	SCICENTR	95.9	95.9	95.9	95.9	95.9	95.9	68.6	68.6	30.2
8	AJAX	97.2	97.2	97.2	97.2	97.2	97.3	97.3	0.0	62.8
9	OSHAWA	90.6	90.6	90.6	90.6	90.6	90.6	94.5	94.5	64.3

Table 9. Averages and data availability summaries for 1988 from the PAQMOS-26m station. Note that wind speed variances were only recorded from JD056 onwards, necessitating multiple parts to the table.

TowerNet Data Averages

p?tt
Pickering NGS 87/88 Met. Study - TallTower

Averaging Period - Start 1988 001JD 00:10 1988 January 01 00:10
End 1988 056JD 15:00 1988 February 25 15:00

Averages

PN ID	SSPD1.5 m/s	SSPD4 m/s	SSPD8 m/s	SSPD16 m/s	SSPD26 m/s	DT 4-1.5 C	DT 8-1.5 C	DT16-1.5 C	DT26-1.5 C
1 CHERRYTT	3.0	3.6	4.0	4.8	5.4	0.08	0.14	0.18	0.17

Standard Deviations

PN ID	SSPD1.5 m/s	SSPD4 m/s	SSPD8 m/s	SSPD16 m/s	SSPD26 m/s	DT 4-1.5 C	DT 8-1.5 C	DT16-1.5 C	DT26-1.5 C
1 CHERRYTT	1.7	1.9	2.1	2.4	2.6	0.36	0.63	0.93	1.11

Data Availability (%)

PN ID	SSPD1.5 m/s	SSPD4 m/s	SSPD8 m/s	SSPD16 m/s	SSPD26 m/s	DT 4-1.5 C	DT 8-1.5 C	DT16-1.5 C	DT26-1.5 C
1 CHERRYTT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

p?tv
Pickering NGS 87/88/89 Met. Study - TallTower (w.variance)

Averaging Period - Start 1988 056JD 15:10 1988 February 25 15:10
End 1989 001JD 00:00 1989 January 01 00:00

Averages

PN ID	SSPD1.5 m/s	SSPD4 m/s	SSPD8 m/s	SSPD16 m/s	SSPD26 m/s	DT 4-1.5 C	DT 8-1.5 C	DT16-1.5 C	DT26-1.5 C
1 CHERRYTV	1.94	2.69	3.05	3.68	4.31	0.07	0.15	0.25	0.32

Standard Deviations

PN ID	SSPD1.5 m/s	SSPD4 m/s	SSPD8 m/s	SSPD16 m/s	SSPD26 m/s	DT 4-1.5 C	DT 8-1.5 C	DT16-1.5 C	DT26-1.5 C
1 CHERRYTV	1.42	1.72	1.89	2.08	2.26	0.64	1.01	1.41	1.72

Data Availability (%)

PN ID	SSPD1.5 m/s	SSPD4 m/s	SSPD8 m/s	SSPD16 m/s	SSPD26 m/s	DT 4-1.5 C	DT 8-1.5 C	DT16-1.5 C	DT26-1.5 C
1 CHERRYTV	99.3	99.3	99.3	99.3	99.3	99.3	99.3	99.3	99.3

Table 9. Continued.

```
    TowerNet Data Averages
    ----------------------

p?tv
Pickering NGS 87/88/89 Met. Study - TallTower (w.variance)

    Averaging Period  -  Start  1988 056JD 15:10      1988 February 25 15:10
                         End    1989 001JD 00:00      1989 January 01 00:00

    Averages
    --------
             PN ID          SGSPD1.5SGSPD4  SGSPD8  SGSPD16 SGSPD26
                             m/s     m/s     m/s     m/s     m/s
              1 CHERRYTV   0.604   0.703   0.757   0.821   0.838

    Standard Deviations
    -------------------
             PN ID          SGSPD1.5SGSPD4  SGSPD8  SGSPD16 SGSPD26
                             m/s     m/s     m/s     m/s     m/s
              1 CHERRYTV   0.414   0.440   0.470   0.511   0.530

    Data Availability (%)
    ---------------------
             PN ID          SGSPD1.5SGSPD4  SGSPD8  SGSPD16 SGSPD26
                             m/s     m/s     m/s     m/s     m/s
              1 CHERRYTV    99.3    99.3    99.3    99.3    99.3
```

Table 10. Monthly averages and data availability summaries from PAQMOS-10m stations; January to December, 1988. The summaries follow.

TowerNet Data Averages

p7pq
Pickering NGS 87/88/89 Met. Study - PAQMOS

Averaging Period - Start 1988 001JD 00:10 1988 January 01 00:10
End 1988 032JD 00:00 1988 February 01 00:00

Averages

PN	ID	SSPD	SGSSPD	MXSSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	4.14	0.96	6.96	2.32	248.	12.1	-5.3	69.	100.07
2	PICKERNG	5.71	0.99	8.45	3.33	251.	10.9	-2.8	-N/A-	101.07
3	GRNWOOD	2.53	0.84	5.13	1.10	251.	18.3	-4.0	-N/A-	100.26
4	CLAREMNT	4.49	0.80	6.84	2.80	242.	10.0	-6.3	70.	98.98
5	EASTPNT	5.18	1.06	8.21	3.22	244.	12.1	-3.9	67.	100.79
6	SCARB	4.43	1.05	7.55	2.07	238.	13.6	-1.9	-N/A-	99.65
7	SCICENTR	3.89	1.27	7.54	2.49	242.	18.6	-4.1	69.	100.15
8	AJAX	4.25	0.77	6.42	1.94	242.	10.1	-4.2	-N/A-	100.50
9	OSHAWA	4.23	0.82	6.66	2.16	250.	10.8	-6.1	70.	100.21

Standard Deviations

PN	ID	SSPD	SGSSPD	MXSSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	2.13	0.57	3.83	-N/A-	-N/A-	5.0	7.4	12.	0.90
2	PICKERNG	2.79	0.48	3.95	-N/A-	-N/A-	5.0	6.8	-N/A-	0.94
3	GRNWOOD	1.50	0.50	3.10	-N/A-	-N/A-	6.9	7.8	-N/A-	0.88
4	CLAREMNT	2.88	0.51	4.29	-N/A-	-N/A-	4.4	7.6	11.	0.74
5	EASTPNT	2.43	0.51	3.82	-N/A-	-N/A-	5.5	6.6	13.	1.03
6	SCARB	1.94	0.47	3.38	-N/A-	-N/A-	4.7	7.4	-N/A-	0.94
7	SCICENTR	1.83	0.62	3.55	-N/A-	-N/A-	6.0	6.8	13.	0.83
8	AJAX	2.44	0.46	3.66	-N/A-	-N/A-	5.2	7.5	-N/A-	0.96
9	OSHAWA	2.32	0.50	3.80	-N/A-	-N/A-	4.8	7.4	12.	0.90

Data Availability (%)

PN	ID	SSPD	SGSSPD	MXSSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	PICKERNG	100.0	100.0	100.0	100.0	100.0	100.0	81.5	0.0	100.0
3	GRNWOOD	78.5	78.5	78.5	78.5	78.5	78.5	78.5	0.0	78.5
4	CLAREMNT	71.8	71.8	71.8	71.8	71.8	71.8	71.8	71.8	71.8
5	EASTPNT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	82.2
6	SCARB	62.6	62.6	62.6	62.6	62.6	62.6	62.6	0.0	62.6
7	SCICENTR	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
8	AJAX	81.7	81.7	81.7	81.7	81.7	81.7	81.7	0.0	81.7
9	OSHAWA	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TowerNet Data Averages

p7pq
Pickering NGS 87/88/89 Met. Study - PAQMOS

Averaging Period - Start 1988 032JD 00:10 1988 February 01 00:10
End 1988 061JD 00:00 1988 March 01 00:00

Averages

PN	ID	SSPD	SGSSPD	MXSSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	4.16	0.91	6.81	1.39	276.	11.4	-7.1	71.	99.74
2	PICKERNG	5.71	1.01	8.52	2.58	265.	10.9	-4.3	-M/A-	100.65
3	GRNWOOD	2.92	0.95	5.89	1.33	275.	17.6	-5.9	-M/A-	99.97
4	CLAREMNT	4.90	0.81	7.26	1.92	263.	9.3	-7.2	72.	98.42
5	EASTPNT	5.27	1.07	8.31	2.21	264.	11.9	-5.1	70.	100.44
6	SCARB	4.52	1.05	7.63	1.85	268.	13.1	-5.2	-M/A-	99.42
7	SCICENTR	3.65	1.26	7.28	1.61	263.	19.6	-5.3	72.	99.78
8	AJAX	4.78	0.84	7.19	2.05	264.	9.5	-5.7	-M/A-	100.16
9	OSHAWA	4.02	0.78	6.33	1.40	301.	10.9	-7.8	71.	100.08

Standard Deviations

PN	ID	SSPD	SGSSPD	MXSSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	1.89	0.49	3.33	-M/A-	-M/A-	3.5	5.8	11.	0.96
2	PICKERNG	3.05	0.50	4.10	-M/A-	-M/A-	4.6	5.4	-M/A-	1.01
3	GRNWOOD	1.41	0.50	3.03	-M/A-	-M/A-	5.3	6.0	-M/A-	0.97
4	CLAREMNT	2.39	0.42	3.51	-M/A-	-M/A-	4.1	5.6	10.	0.97
5	EASTPNT	2.68	0.50	3.94	-M/A-	-M/A-	4.4	5.4	12.	1.03
6	SCARB	1.90	0.48	3.40	-M/A-	-M/A-	3.9	5.5	-M/A-	0.98
7	SCICENTR	1.81	0.59	3.39	-M/A-	-M/A-	6.5	5.2	12.	0.92
8	AJAX	2.53	0.46	3.75	-M/A-	-M/A-	4.2	5.7	-M/A-	0.99
9	OSHAWA	2.09	0.43	3.34	-M/A-	-M/A-	4.4	5.6	10.	0.90

Data Availability (%)

PN	ID	SSPD	SGSSPD	MXSSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2
2	PICKERNG	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
3	GRNWOOD	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
4	CLAREMNT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
5	EASTPNT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
6	SCARB	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
7	SCICENTR	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
8	AJAX	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
9	OSHAWA	67.9	67.9	67.9	67.9	67.9	67.9	67.9	67.9	67.0

TowerNet Data Averages

p7pq
Pickering NGS 87/88/89 Met. Study - PAQMOS

Averaging Period - Start 1988 061JD 00:10 1988 March 01 00:10
End 1988 092JD 00:00 1988 April 01 00:00

Averages

PN	ID	SSPD	SGSSPD	MXSSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	3.68	0.87	6.20	1.27	304.	13.4	-1.6	68.	99.76
2	PICKERNG	4.69	0.86	7.11	0.72	342.	12.6	-0.1	-M/A-	100.69
3	GRNWOOD	2.56	0.81	5.02	1.02	303.	18.5	-1.1	-M/A-	100.10
4	CLAREMNT	4.53	0.78	6.71	1.55	298.	10.2	-2.1	68.	98.55
5	EASTPNT	4.40	0.94	7.00	1.14	314.	13.1	-0.6	67.	100.51
6	SCARB	4.07	0.97	6.86	1.22	309.	13.9	-0.2	-M/A-	99.51
7	SCICENTR	3.13	1.13	6.34	1.39	309.	21.0	-0.4	72.	-M/A-
8	AJAX	3.89	0.78	6.06	1.19	305.	11.5	-0.7	-M/A-	100.29
9	OSHAWA	3.57	0.75	5.75	1.78	325.	11.7	-2.0	67.	99.92

Standard Deviations

PN	ID	SSPD	SGSSPD	MXSSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	1.72	0.47	3.06	-M/A-	-M/A-	5.2	6.1	13.	0.85
2	PICKERNG	2.67	0.39	3.37	-M/A-	-M/A-	6.9	5.3	-M/A-	0.92
3	GRNWOOD	1.45	0.46	2.86	-M/A-	-M/A-	7.6	6.3	-M/A-	0.84
4	CLAREMNT	2.24	0.40	3.24	-M/A-	-M/A-	5.1	6.0	13.	0.84
5	EASTPNT	2.19	0.44	3.23	-M/A-	-M/A-	6.0	5.2	14.	0.88
6	SCARB	1.70	0.42	2.92	-M/A-	-M/A-	4.8	5.7	-M/A-	0.87
7	SCICENTR	1.38	0.47	2.61	-M/A-	-M/A-	6.5	5.7	15.	-M/A-
8	AJAX	2.15	0.43	3.25	-M/A-	-M/A-	6.0	5.9	-M/A-	0.88
9	OSHAWA	1.73	0.40	2.85	-M/A-	-M/A-	5.1	6.3	13.	0.85

Data Availability (%)

PN	ID	SSPD	SGSSPD	MXSSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	PICKERNG	76.0	76.0	76.0	76.0	76.0	76.0	76.0	0.0	76.0
3	GRNWOOD	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
4	CLAREMNT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
5	EASTPNT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
6	SCARB	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
7	SCICENTR	65.9	65.9	65.9	65.9	65.9	65.9	100.0	100.0	0.0
8	AJAX	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
9	OSHAWA	65.8	65.8	65.8	65.8	65.8	65.8	99.9	99.9	99.9

TowerNet Data Averages

p?pc
Pickering NGS 87/88/89 Met. Study - PAQMOS

Averaging Period - Start 1988 092JD 00:10 1988 April 01 00:10
End 1988 122JD 00:00 1988 May 01 00:00

Averages

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	3.76	0.87	6.27	1.17	328.	13.3	5.0	73.	99.18
2	PICKERNG	4.43	0.80	6.71	0.84	338.	11.5	5.8	-M/A-	100.11
3	GRNWOOD	2.63	0.84	5.17	0.92	314.	18.7	5.6	-M/A-	99.55
4	CLAREMNT	4.80	0.86	7.20	2.39	301.	9.5	4.7	71.	98.05
5	EASTPNT	4.30	0.89	6.79	1.26	326.	12.1	5.0	73.	99.86
6	SCARB	4.03	0.92	6.70	1.15	336.	13.7	6.1	-M/A-	99.21
7	SCICENTR	3.13	1.12	6.35	1.02	332.	21.1	5.8	80.	-M/A-
8	AJAX	4.08	0.81	6.35	0.96	322.	11.3	5.8	-M/A-	99.68
9	OSHAWA	4.09	0.88	6.67	1.21	337.	12.7	4.7	71.	99.35

Standard Deviations

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	1.96	0.50	3.39	-M/A-	-M/A-	5.2	4.2	16.	0.67
2	PICKERNG	2.35	0.42	3.26	-M/A-	-M/A-	6.0	2.7	-M/A-	0.67
3	GRNWOOD	1.60	0.52	3.23	-M/A-	-M/A-	7.4	4.7	-M/A-	0.68
4	CLAREMNT	2.56	0.48	3.76	-M/A-	-M/A-	5.7	4.2	16.	0.65
5	EASTPNT	2.17	0.49	3.35	-M/A-	-M/A-	5.4	3.1	16.	0.69
6	SCARB	1.91	0.47	3.26	-M/A-	-M/A-	5.3	3.6	-M/A-	0.79
7	SCICENTR	1.61	0.58	3.18	-M/A-	-M/A-	7.4	3.6	19.	-M/A-
8	AJAX	2.32	0.50	3.61	-M/A-	-M/A-	6.0	4.0	-M/A-	0.69
9	OSHAWA	2.07	0.50	3.49	-M/A-	-M/A-	6.1	4.5	16.	0.68

Data Availability (%)

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	PICKERNG	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
3	GRNWOOD	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
4	CLAREMNT	62.7	62.7	62.7	62.7	62.7	62.7	100.0	100.0	100.0
5	EASTPNT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
6	SCARB	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	30.0
7	SCICENTR	84.7	84.7	84.7	84.7	84.7	84.7	100.0	100.0	0.0
8	AJAX	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
9	OSHAWA	84.6	84.6	84.6	84.6	84.6	84.6	97.1	97.1	97.1

TowerNet Data Averages

p?pq
Pickering NGS 87/88/89 Met. Study - PAQMOS

Averaging Period - Start 1988 122JD 00:10 1988 May 01 00:10
End 1988 153JD 00:00 1988 June 01 00:00

Averages

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	3.04	0.69	4.99	0.35	352.	13.7	13.0	68.	99.75
2	PICKERNG	3.06	0.57	4.65	0.37	331.	11.9	12.2	-M/A-	100.63
3	GRNWOOD	2.10	0.68	4.08	0.20	295.	19.1	13.5	-M/A-	100.12
4	CLAREMNT	3.46	0.72	5.44	0.60	322.	10.4	13.1	63.	98.76
5	EASTPNT	3.18	0.67	5.02	0.61	302.	12.5	12.0	71.	100.36
6	SCARB	3.01	0.76	5.08	0.38	22.	14.3	14.8	-M/A-	99.40
7	SCICENTR	2.56	0.84	4.91	0.14	278.	19.8	14.3	65.	99.69
8	AJAX	3.18	0.63	4.91	0.24	296.	11.9	13.4	-M/A-	100.21
9	OSHAWA	3.09	0.66	4.94	0.65	336.	13.5	12.8	67.	99.92

Standard Deviations

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	1.72	0.43	2.97	-M/A-	-M/A-	7.2	6.2	21.	0.46
2	PICKERNG	1.67	0.36	2.54	-M/A-	-M/A-	7.3	4.4	-M/A-	0.46
3	GRNWOOD	1.33	0.44	2.67	-M/A-	-M/A-	9.0	6.4	-M/A-	0.45
4	CLAREMNT	2.05	0.43	3.17	-M/A-	-M/A-	7.1	6.0	21.	0.47
5	EASTPNT	1.78	0.42	2.87	-M/A-	-M/A-	7.6	5.1	19.	0.45
6	SCARB	1.85	0.42	3.00	-M/A-	-M/A-	6.8	5.9	-M/A-	0.15
7	SCICENTR	1.52	0.50	2.88	-M/A-	-M/A-	7.5	5.7	21.	0.15
8	AJAX	2.01	0.42	3.12	-M/A-	-M/A-	7.1	5.6	-M/A-	0.45
9	OSHAWA	1.67	0.40	2.80	-M/A-	-M/A-	9.9	6.0	20.	0.43

Data Availability (%)

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	PICKERNG	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
3	GRNWOOD	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
4	CLAREMNT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	61.3
5	EASTPNT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
6	SCARB	92.0	92.0	92.0	92.0	92.0	92.0	92.0	0.0	5.2
7	SCICENTR	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	5.3
8	AJAX	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
9	OSHAWA	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TowerNet Data Averages

p?pq
Pickering NGS 87/88/89 Met. Study - PAQMOS

Averaging Period - Start 1988 153JD 00:10 1988 June 01 00:10
End 1988 183JD 00:00 1988 July 01 00:00

Averages

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	3.47	0.92	6.19	2.00	310.	15.7	17.6	57.	99.72
2	PICKERNG	3.28	0.78	5.57	1.86	299.	14.5	16.6	-M/A-	100.58
3	GRNWOOD	2.47	0.85	5.09	1.42	311.	20.3	17.5	-M/A-	100.06
4	CLAREMNT	4.28	0.91	6.83	2.88	327.	10.2	16.9	52.	-M/A-
5	EASTPNT	3.77	0.89	6.33	2.34	295.	14.3	16.8	59.	100.33
6	SCARB	3.87	1.08	6.84	2.03	310.	14.9	19.3	-M/A-	99.29
7	SCICENTR	3.05	1.04	6.07	1.47	313.	20.7	18.4	48.	99.71
8	AJAX	3.63	0.84	5.98	1.91	301.	12.9	17.6	-M/A-	100.20
9	OSHAWA	3.36	0.80	5.72	1.80	310.	16.0	16.4	60.	99.91

Standard Deviations

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	1.67	0.51	3.15	-M/A-	-M/A-	5.6	6.6	19.	0.46
2	PICKERNG	1.51	0.46	2.84	-M/A-	-M/A-	7.4	4.3	-M/A-	0.49
3	GRNWOOD	1.39	0.51	3.02	-M/A-	-M/A-	8.0	6.4	-M/A-	0.48
4	CLAREMNT	2.37	0.51	3.69	-M/A-	-M/A-	6.4	6.6	19.	-M/A-
5	EASTPNT	1.74	0.49	3.06	-M/A-	-M/A-	11.5	5.1	17.	0.50
6	SCARB	1.88	0.42	3.06	-M/A-	-M/A-	5.0	6.2	-M/A-	0.39
7	SCICENTR	1.49	0.55	3.02	-M/A-	-M/A-	6.7	6.6	16.	0.43
8	AJAX	2.07	0.52	3.47	-M/A-	-M/A-	6.4	6.1	-M/A-	0.44
9	OSHAWA	1.74	0.47	3.12	-M/A-	-M/A-	9.6	6.2	19.	0.48

Data Availability (%)

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	PICKERNG	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
3	GRNWOOD	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
4	CLAREMNT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0
5	EASTPNT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
6	SCARB	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	26.6
7	SCICENTR	100.0	100.0	100.0	100.0	100.0	100.0	63.3	63.3	26.6
8	AJAX	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	93.3
9	OSHAWA	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TowerNet Data Averages

p?pq
Pickering NGS 87/88/89 Met. Study - PAQMOS

Averaging Period - Start 1988 183JD 00:10 1988 July 01 00:10
End 1988 214JD 00:00 1988 August 01 00:00

Averages

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	2.30	0.57	3.88	0.47	312.	15.1	22.1	71.	99.91
2	PICKERNG	2.51	0.48	3.83	0.72	280.	12.1	22.0	-M/A-	100.73
3	GRNWOOD	1.65	0.55	3.22	0.45	287.	19.7	22.3	-M/A-	100.21
4	CLAREMNT	4.03	0.91	6.67	3.70	8.	11.2	16.0	59.	-M/A-
5	EASTPNT	2.65	0.56	4.15	1.29	264.	11.5	21.6	73.	100.46
6	SCARB	2.32	0.78	4.32	0.46	272.	15.4	24.3	-M/A-	99.33
7	SCICENTR	2.11	0.69	4.00	0.46	264.	19.9	-M/A-	-M/A-	99.69
8	AJAX	2.42	0.52	3.81	0.62	275.	12.6	22.8	-M/A-	100.32
9	OSHAWA	2.36	0.53	3.80	0.46	281.	16.0	21.6	70.	100.13

Standard Deviations

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	1.30	0.37	2.31	-M/A-	-M/A-	8.7	6.1	22.	0.44
2	PICKERNG	1.27	0.31	2.01	-M/A-	-M/A-	7.6	3.7	-M/A-	0.36
3	GRNWOOD	1.01	0.37	2.09	-M/A-	-M/A-	9.8	5.9	-M/A-	0.38
4	CLAREMNT	1.56	0.50	2.95	-M/A-	-M/A-	5.5	4.7	19.	-M/A-
5	EASTPNT	1.47	0.34	2.34	-M/A-	-M/A-	11.3	4.6	19.	0.41
6	SCARB	1.74	0.44	2.77	-M/A-	-M/A-	7.6	5.1	-M/A-	0.37
7	SCICENTR	1.28	0.43	2.45	-M/A-	-M/A-	8.8	-M/A-	-M/A-	0.38
8	AJAX	1.39	0.35	2.28	-M/A-	-M/A-	8.3	5.6	-M/A-	0.36
9	OSHAWA	1.29	0.33	2.16	-M/A-	-M/A-	11.6	5.8	20.	0.46

Data Availability (%)

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	PICKERNG	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
3	GRNWOOD	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
4	CLAREMNT	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	0.0
5	EASTPNT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
6	SCARB	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	77.4
7	SCICENTR	100.0	100.0	100.0	100.0	100.0	100.0	0.0	0.0	77.4
8	AJAX	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	74.2
9	OSHAWA	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TowerNet Data Averages

p?pq
Pickering NGS 87/88/89 Met. Study - PAQMOS

Averaging Period - Start 1988 214JD 00:10 1988 August 01 00:10
End 1988 245JD 00:00 1988 September 01 00:00

Averages

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	2.55	0.67	4.45	0.64	250.	14.5	20.2	77.	99.81
2	PICKERNG	3.31	0.58	4.90	1.11	245.	11.5	21.2	-M/A-	100.69
3	GRNWOOD	1.80	0.64	3.66	0.49	247.	20.2	20.6	-M/A-	100.12
4	CLARMNT	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-
5	EASTPNT	3.34	0.68	5.19	1.89	256.	10.2	20.0	78.	100.47
6	SCARB	2.83	0.84	5.08	1.04	230.	14.5	22.2	-M/A-	99.43
7	SCICENTR	2.43	0.80	4.67	0.95	230.	19.5	-M/A-	-M/A-	99.75
8	AJAX	2.94	0.62	4.62	1.07	239.	12.0	20.8	-M/A-	100.39
9	OSHAWA	2.78	0.61	4.46	1.23	259.	13.6	19.6	77.	100.14

Standard Deviations

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	1.54	0.46	2.86	-M/A-	-M/A-	7.7	6.7	20.	0.52
2	PICKERNG	1.89	0.35	2.64	-M/A-	-M/A-	7.1	3.8	-M/A-	0.51
3	GRNWOOD	1.20	0.45	2.58	-M/A-	-M/A-	9.9	6.3	-M/A-	0.50
4	CLARMNT	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-
5	EASTPNT	1.76	0.40	2.82	-M/A-	-M/A-	9.7	4.7	15.	0.50
6	SCARB	1.90	0.44	3.07	-M/A-	-M/A-	5.8	5.3	-M/A-	0.30
7	SCICENTR	1.43	0.49	2.79	-M/A-	-M/A-	8.1	-M/A-	-M/A-	0.33
8	AJAX	1.98	0.44	3.12	-M/A-	-M/A-	7.5	6.1	-M/A-	0.47
9	OSHAWA	1.81	0.41	2.94	-M/A-	-M/A-	12.3	6.3	18.	0.44

Data Availability (%)

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	PICKERNG	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
3	GRNWOOD	96.8	96.8	96.8	96.8	96.8	96.8	96.8	0.0	96.8
4	CLARMNT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	EASTPNT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	87.1
6	SCARB	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	54.8
7	SCICENTR	100.0	100.0	100.0	100.0	100.0	100.0	0.0	0.0	54.8
8	AJAX	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	87.1
9	OSHAWA	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	87.1

TowerNet Data Averages

p?pq
Pickering NGS 87/88/89 Met. Study - PAQMOS

Averaging Period - Start 1988 245JD 00:10 1988 September 01 00:10
End 1988 275JD 00:00 1988 October 01 00:00

Averages

PN	ID	SSPD	SGSSPD	MXSSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	2.76	0.74	4.89	0.55	273.	14.1	14.0	80.	99.99
2	PICKERNG	3.60	0.64	5.39	0.56	271.	11.4	16.5	-M/A-	100.99
3	GRNWOOD	1.93	0.68	3.97	0.46	277.	19.9	14.3	-M/A-	100.33
4	CLARMNT	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-
5	EASTPNT	3.44	0.72	5.47	1.31	259.	10.1	14.5	80.	101.56
6	SCARB	3.15	0.88	5.54	0.86	248.	13.7	16.1	-M/A-	-M/A-
7	SCICENTR	2.47	0.85	4.91	0.66	237.	19.8	-M/A-	-M/A-	-M/A-
8	AJAX	3.21	0.68	5.09	0.66	263.	11.7	14.7	-M/A-	-M/A-
9	OSHAWA	3.09	0.66	4.99	0.50	269.	11.8	13.5	80.	-M/A-

Standard Deviations

PN	ID	SSPD	SGSSPD	MXSSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	1.59	0.48	3.00	-M/A-	-M/A-	6.7	5.5	19.	0.77
2	PICKERNG	1.87	0.38	2.70	-M/A-	-M/A-	7.4	3.7	-M/A-	0.78
3	GRNWOOD	1.28	0.48	2.78	-M/A-	-M/A-	9.1	5.4	-M/A-	0.74
4	CLARMNT	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-
5	EASTPNT	1.78	0.44	2.92	-M/A-	-M/A-	8.2	4.2	16.	0.49
6	SCARB	1.87	0.44	3.10	-M/A-	-M/A-	5.4	4.3	-M/A-	-M/A-
7	SCICENTR	1.44	0.51	2.87	-M/A-	-M/A-	7.5	-M/A-	-M/A-	-M/A-
8	AJAX	2.05	0.47	3.27	-M/A-	-M/A-	6.7	4.9	-M/A-	-M/A-
9	OSHAWA	1.82	0.44	3.07	-M/A-	-M/A-	6.6	5.3	17.	-M/A-

Data Availability (%)

PN	ID	SSPD	SGSSPD	MXSSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	PICKERNG	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
3	GRNWOOD	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
4	CLARMNT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	EASTPNT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	13.3
6	SCARB	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	0.0
7	SCICENTR	100.0	100.0	100.0	100.0	100.0	100.0	0.0	0.0	0.0
8	AJAX	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	0.0
9	OSHAWA	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0

TowerNet Data Averages

p7pq
Pickering NGS 87/88/89 Met. Study - PAQMOS

Averaging Period - Start 1988 275JD 00:10 1988 October 01 00:10
End 1988 306JD 00:00 1988 November 01 00:00

Averages

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	3.19	0.78	5.48	1.16	258.	12.8	5.6	81.	99.75
2	PICKERNG	4.30	0.76	6.42	1.61	261.	11.3	8.9	-M/A-	100.71
3	GRNWOOD	2.21	0.75	4.53	0.85	265.	18.7	13.8	-M/A-	100.09
4	CLAREMNT	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-
5	EASTPNT	3.77	0.81	6.06	1.74	260.	11.4	6.5	79.	100.70
6	SCARB	3.38	0.91	5.96	1.36	250.	14.0	7.5	-M/A-	100.25
7	SCICENTR	2.75	0.97	5.54	1.14	247.	19.8	5.1	67.	-M/A-
8	AJAX	3.56	0.73	5.61	1.43	256.	11.0	6.5	-M/A-	100.30
9	OSHAWA	3.45	0.71	5.52	1.11	267.	11.1	5.2	81.	100.02

Standard Deviations

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	1.71	0.50	3.20	-M/A-	-M/A-	5.9	5.5	15.	0.88
2	PICKERNG	2.35	0.42	3.28	-M/A-	-M/A-	5.9	4.0	-M/A-	0.90
3	GRNWOOD	1.33	0.49	2.90	-M/A-	-M/A-	7.4	5.5	-M/A-	0.90
4	CLAREMNT	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-
5	EASTPNT	2.02	0.47	3.32	-M/A-	-M/A-	6.7	4.4	14.	0.92
6	SCARB	1.91	0.44	3.23	-M/A-	-M/A-	5.1	4.8	-M/A-	0.41
7	SCICENTR	1.57	0.56	3.13	-M/A-	-M/A-	7.0	4.2	14.	-M/A-
8	AJAX	2.16	0.49	3.47	-M/A-	-M/A-	5.6	5.1	-M/A-	1.12
9	OSHAWA	1.97	0.45	3.29	-M/A-	-M/A-	5.8	5.5	14.	1.11

Data Availability (%)

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	PICKERNG	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
3	GRNWOOD	100.0	100.0	100.0	100.0	100.0	100.0	9.7	0.0	100.0
4	CLAREMNT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	EASTPNT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	37.5
6	SCARB	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	10.8
7	SCICENTR	100.0	100.0	100.0	100.0	100.0	100.0	61.3	61.3	0.0
8	AJAX	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	18.2
9	OSHAWA	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	18.2

TowerNet Data Averages

p?pq
Pickering NGS 87/88/89 Met. Study - PAQMOS

Averaging Period - Start 1988 306JD 00:10 1988 November 01 00:10
End 1988 336JD 00:00 1988 December 01 00:00

Averages

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	¿¤g	C	%	kPa
1	CHERRYWD	3.61	0.86	6.13	0.97	248.	11.9	3.3	80.	98.47
2	PICKERNG	5.28	0.81	7.54	0.73	216.	9.7	6.8	-M/A-	100.33
3	GRNWOOD	2.57	0.85	5.20	0.62	248.	18.1	4.0	-M/A-	99.84
4	CLAREMNT	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-
5	EASTPNT	4.58	0.92	7.15	0.90	245.	10.9	4.3	78.	-M/A-
6	SCARB	3.70	0.99	6.57	0.98	235.	13.6	4.9	-M/A-	99.28
7	SCICENTR	3.20	1.11	6.39	0.98	229.	19.7	3.7	69.	-M/A-
8	AJAX	4.30	0.80	6.60	0.93	230.	9.6	4.6	-M/A-	-M/A-
9	OSHAWA	4.07	0.81	6.45	0.65	229.	10.4	3.3	78.	-M/A-

Standard Deviations

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	2.21	0.59	3.97	-M/A-	-M/A-	5.0	3.8	13.	0.73
2	PICKERNG	2.68	0.46	3.73	-M/A-	-M/A-	5.5	2.5	-M/A-	0.99
3	GRNWOOD	1.65	0.57	3.54	-M/A-	-M/A-	6.9	3.9	-M/A-	0.99
4	CLAREMNT	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-
5	EASTPNT	2.43	0.50	3.75	-M/A-	-M/A-	4.9	2.7	13.	-M/A-
6	SCARB	2.28	0.52	3.87	-M/A-	-M/A-	5.2	3.1	-M/A-	0.99
7	SCICENTR	1.88	0.64	3.68	-M/A-	-M/A-	6.4	2.8	11.	-M/A-
8	AJAX	2.71	0.54	4.22	-M/A-	-M/A-	4.9	3.6	-M/A-	-M/A-
9	OSHAWA	2.26	0.51	3.80	-M/A-	-M/A-	4.8	3.9	12.	-M/A-

Data Availability (%)

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	86.6	86.6	86.6	86.6	86.6	86.6	86.6	86.6	16.6
2	PICKERNG	85.0	85.0	85.0	85.0	85.0	85.0	84.5	0.0	78.3
3	GRNWOOD	100.0	100.0	100.0	100.0	100.0	100.0	98.3	0.0	100.0
4	CLAREMNT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	EASTPNT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0
6	SCARB	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
7	SCICENTR	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0
8	AJAX	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	0.0
9	OSHAWA	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0

TowerMet Data Averages

p?pq
Pickering NGS 87/88/89 Met. Study - PAQMOS

Averaging Period - Start 1988 336JD 00:10 1988 December 01 00:10
End 1989 001JD 00:00 1989 January 01 00:00

Averages

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	3.79	0.90	6.44	1.87	264.	12.3	-3.8	74.	100.12
2	PICKERNG	5.21	0.93	7.81	2.55	259.	11.3	-0.6	-M/A-	100.85
3	GRNWOOD	2.85	0.95	5.84	1.82	269.	18.0	-2.4	-M/A-	100.11
4	CLAREMNT	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-
5	EASTPNT	4.55	0.98	7.36	2.88	265.	12.5	-2.9	69.	109.23
6	SCARB	4.30	1.10	7.53	2.52	256.	13.4	-0.8	-M/A-	99.55
7	SCICENTR	3.44	1.22	6.97	1.85	254.	20.1	-2.3	65.	-M/A-
8	AJAX	4.41	0.86	6.89	2.10	264.	9.9	-2.8	-M/A-	-M/A-
9	OSHAWA	4.02	0.79	6.37	1.85	276.	10.3	-3.2	75.	100.24

Standard Deviations

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	1.99	0.55	3.62	-M/A-	-M/A-	4.2	6.0	12.	0.00
2	PICKERNG	2.67	0.41	3.60	-M/A-	-M/A-	4.8	5.8	-M/A-	0.76
3	GRNWOOD	1.91	0.63	4.01	-M/A-	-M/A-	6.0	5.5	-M/A-	0.78
4	CLAREMNT	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-	-M/A-
5	EASTPNT	2.20	0.52	3.59	-M/A-	-M/A-	5.8	5.6	13.	0.00
6	SCARB	2.21	0.53	3.84	-M/A-	-M/A-	3.7	4.9	-M/A-	0.76
7	SCICENTR	1.74	0.62	3.43	-M/A-	-M/A-	6.6	4.7	10.	-M/A-
8	AJAX	2.37	0.51	3.75	-M/A-	-M/A-	4.2	5.8	-M/A-	-M/A-
9	OSHAWA	2.19	0.50	3.67	-M/A-	-M/A-	3.6	5.0	12.	0.00

Data Availability (%)

PN	ID	SSPD	SGSSPD	MISSPD	VSPD	DIR	SGDIR	TEMP	HUM	BPRES
		m/s	m/s	m/s	m/s	degt	deg	C	%	kPa
1	CHERRYWD	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0
2	PICKERNG	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0
3	GRNWOOD	27.3	27.3	27.3	27.3	27.3	27.3	79.0	0.0	78.9
4	CLAREMNT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	EASTPNT	82.5	82.5	82.5	82.5	82.5	82.5	82.3	82.5	0.0
6	SCARB	81.6	81.6	81.6	81.6	81.6	81.6	81.6	0.0	81.6
7	SCICENTR	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0
8	AJAX	85.8	85.8	85.8	85.8	85.8	85.9	85.9	0.0	0.0
9	OSHAWA	68.6	68.6	68.6	68.6	68.6	68.6	68.6	68.6	0.0

Table 11. Periods of missing data for the PAQMOS-26m; otherwise all wind speeds (5 levels), wind speed variances (5 levels) and temperature differentials (4 differences) are available in the archive for 1988.

Period beginning: (JD,hhmm)	Period ending: (JD,hhmm)	Missing Data	Comments
001,0000	056,1500	All speed variances (6-10)	Not programmed.
056,1500	056,1520	All data (1-14)	Reprogramming datalogger.
108,1450	110,2030	All data (1-14)	Datalogger problem.

Table 12 Joint frequency distribution for Cherrywood, January 1988.

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class A

Statistics Period - Start 1988 001JD 00:10 1988 January 01 00:10
End 1988 032JD 00:00 1988 February 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.11	0.00	0.00	0.00	0.00	0.11
22.5-> 45.0	0.25	0.09	0.00	0.00	0.00	0.34
45.0-> 67.5	0.13	0.07	0.00	0.00	0.00	0.20
67.5-> 90.0	0.11	0.07	0.02	0.00	0.00	0.20
90.0->112.5	0.09	0.02	0.00	0.00	0.00	0.11
112.5->135.0	0.00	0.02	0.00	0.00	0.00	0.02
135.0->157.5	0.18	0.13	0.02	0.00	0.00	0.34
157.5->180.0	0.00	0.07	0.04	0.00	0.00	0.11
180.0->202.5	0.22	0.20	0.07	0.00	0.00	0.49
202.5->225.0	0.36	0.07	0.02	0.00	0.00	0.45
225.0->247.5	0.25	0.25	0.00	0.00	0.00	0.49
247.5->270.0	0.36	0.02	0.00	0.00	0.00	0.38
270.0->292.5	0.27	0.00	0.00	0.00	0.00	0.27
292.5->315.0	0.13	0.07	0.00	0.00	0.00	0.20
315.0->337.5	0.04	0.09	0.00	0.00	0.00	0.13
337.5->360.0	0.07	0.00	0.00	0.00	0.00	0.07
SubTotal	2.58	1.16	0.18	0.00	0.00	3.92

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class B

Statistics Period - Start 1988 001JD 00:10 1988 January 01 00:10
End 1988 032JD 00:00 1988 February 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.02	0.00	0.00	0.00	0.00	0.02
22.5-> 45.0	0.02	0.07	0.00	0.00	0.00	0.09
45.0-> 67.5	0.02	0.04	0.00	0.00	0.00	0.07
67.5-> 90.0	0.02	0.04	0.13	0.00	0.00	0.20
90.0->112.5	0.04	0.02	0.00	0.00	0.00	0.07
112.5->135.0	0.04	0.07	0.00	0.00	0.00	0.11
135.0->157.5	0.04	0.13	0.04	0.00	0.00	0.22
157.5->180.0	0.04	0.34	0.07	0.00	0.00	0.45
180.0->202.5	0.18	0.27	0.22	0.00	0.00	0.67
202.5->225.0	0.16	0.13	0.07	0.00	0.00	0.36
225.0->247.5	0.11	0.09	0.00	0.00	0.00	0.20
247.5->270.0	0.16	0.09	0.00	0.00	0.00	0.25
270.0->292.5	0.04	0.02	0.00	0.00	0.00	0.07
292.5->315.0	0.18	0.13	0.00	0.00	0.00	0.31
315.0->337.5	0.09	0.02	0.07	0.00	0.00	0.18
337.5->360.0	0.04	0.07	0.00	0.00	0.00	0.11
SubTotal	1.23	1.55	0.60	0.00	0.00	3.38

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class C

Statistics Period - Start 1988 001JD 00:10 1988 January 01 00:10
End 1988 032JD 00:00 1988 February 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.67	0.07	0.00	0.00	0.00	0.74
22.5-> 45.0	0.29	0.16	0.00	0.00	0.00	0.45
45.0-> 67.5	0.16	0.02	0.00	0.00	0.00	0.18
67.5-> 90.0	0.07	0.04	0.16	0.00	0.00	0.27
90.0->112.5	0.09	0.02	0.00	0.00	0.00	0.11
112.5->135.0	0.11	0.04	0.00	0.00	0.00	0.16
135.0->157.5	0.22	0.11	0.11	0.00	0.00	0.45
157.5->180.0	0.11	0.18	0.11	0.00	0.00	0.40
180.0->202.5	0.22	0.13	0.29	0.02	0.00	0.67
202.5->225.0	0.22	0.22	0.38	0.02	0.00	0.85
225.0->247.5	0.27	0.04	0.29	0.00	0.00	0.60
247.5->270.0	0.27	0.09	0.18	0.00	0.00	0.54
270.0->292.5	0.83	0.04	0.00	0.00	0.00	0.87
292.5->315.0	0.36	0.02	0.09	0.00	0.00	0.47
315.0->337.5	0.67	0.25	0.36	0.00	0.00	1.28
337.5->360.0	1.14	0.04	0.31	0.00	0.00	1.50
SubTotal	5.71	1.50	2.28	0.04	0.00	9.54

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class D

Statistics Period - Start 1988 001JD 00:10 1988 January 01 00:10
End 1988 032JD 00:00 1988 February 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	1.08	0.83	0.94	0.07	0.00	2.91
22.5-> 45.0	0.31	0.16	0.04	0.00	0.00	0.52
45.0-> 67.5	0.25	0.47	0.20	0.00	0.00	0.92
67.5-> 90.0	0.45	0.34	0.25	0.25	0.60	1.88
90.0->112.5	0.56	0.18	0.81	0.31	0.63	2.49
112.5->135.0	0.16	0.09	0.83	0.11	0.00	1.19
135.0->157.5	0.20	0.04	0.16	0.31	0.02	0.74
157.5->180.0	0.09	0.07	0.54	0.09	0.02	0.81
180.0->202.5	0.40	0.38	2.35	1.03	0.74	4.91
202.5->225.0	0.38	0.63	4.17	2.51	3.97	11.65
225.0->247.5	0.43	0.81	8.22	3.36	1.97	14.78
247.5->270.0	0.36	0.94	3.90	2.22	7.39	14.81
270.0->292.5	0.40	0.34	0.72	0.20	0.54	2.20
292.5->315.0	0.25	0.31	1.34	1.14	1.86	4.91
315.0->337.5	0.49	0.63	1.14	1.41	0.94	4.61
337.5->360.0	0.87	0.92	1.84	0.87	0.29	4.79
SubTotal	6.68	7.12	27.44	13.89	18.97	74.10

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class E

Statistics Period - Start 1988 001JD 00:10 1988 January 01 00:10
End 1988 032JD 00:00 1988 February 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.09	0.04	0.00	0.00	0.00	0.13
22.5-> 45.0	0.11	0.07	0.00	0.00	0.00	0.18
45.0-> 67.5	0.04	0.02	0.02	0.00	0.00	0.09
67.5-> 90.0	0.07	0.02	0.00	0.00	0.00	0.09
90.0->112.5	0.02	0.02	0.00	0.00	0.00	0.04
112.5->135.0	0.09	0.07	0.04	0.00	0.00	0.20
135.0->157.5	0.04	0.04	0.16	0.00	0.00	0.25
157.5->180.0	0.04	0.07	0.02	0.00	0.00	0.13
180.0->202.5	0.09	0.18	0.27	0.00	0.00	0.54
202.5->225.0	0.22	0.54	0.83	0.02	0.00	1.61
225.0->247.5	0.13	0.54	0.87	0.00	0.00	1.55
247.5->270.0	0.18	0.34	0.13	0.00	0.00	0.65
270.0->292.5	0.13	0.29	0.00	0.00	0.00	0.43
292.5->315.0	0.20	0.29	0.09	0.00	0.00	0.58
315.0->337.5	0.07	0.07	0.00	0.00	0.00	0.13
337.5->360.0	0.20	0.02	0.00	0.00	0.00	0.22
SubTotal	1.75	2.62	2.44	0.02	0.00	6.83

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class F

Statistics Period - Start 1988 001JD 00:10 1988 January 01 00:10
End 1988 032JD 00:00 1988 February 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.07	0.02	0.00	0.00	0.00	0.09
22.5-> 45.0	0.07	0.00	0.00	0.00	0.00	0.07
45.0-> 67.5	0.04	0.00	0.00	0.00	0.00	0.04
67.5-> 90.0	0.02	0.00	0.00	0.00	0.00	0.02
90.0->112.5	0.00	0.00	0.00	0.00	0.00	0.00
112.5->135.0	0.07	0.07	0.04	0.00	0.00	0.18
135.0->157.5	0.07	0.04	0.07	0.00	0.00	0.18
157.5->180.0	0.00	0.00	0.00	0.00	0.00	0.00
180.0->202.5	0.02	0.22	0.09	0.00	0.00	0.34
202.5->225.0	0.16	0.13	0.02	0.00	0.00	0.31
225.0->247.5	0.18	0.31	0.07	0.00	0.00	0.56
247.5->270.0	0.04	0.00	0.00	0.00	0.00	0.04
270.0->292.5	0.04	0.00	0.00	0.00	0.00	0.04
292.5->315.0	0.09	0.11	0.00	0.00	0.00	0.20
315.0->337.5	0.04	0.07	0.00	0.00	0.00	0.11
337.5->360.0	0.00	0.00	0.02	0.00	0.00	0.02
SubTotal	0.92	0.99	0.31	0.00	0.00	2.22

Table 13 Joint frequency distribution for Cherrywood, February 1988.

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class A

Statistics Period - Start 1988 032JD 00:10 1988 February 01 00:10
End 1988 061JD 00:00 1988 March 01 00:00

4174 10min averages used for statistics.
4176 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.05	0.05	0.02	0.00	0.00	0.12
22.5-> 45.0	0.14	0.05	0.02	0.00	0.00	0.22
45.0-> 67.5	0.07	0.02	0.00	0.00	0.00	0.10
67.5-> 90.0	0.05	0.00	0.00	0.00	0.00	0.05
90.0->112.5	0.00	0.00	0.00	0.00	0.00	0.00
112.5->135.0	0.00	0.00	0.00	0.00	0.00	0.00
135.0->157.5	0.00	0.00	0.00	0.00	0.00	0.00
157.5->180.0	0.02	0.00	0.00	0.00	0.00	0.02
180.0->202.5	0.07	0.00	0.00	0.00	0.00	0.07
202.5->225.0	0.05	0.02	0.00	0.00	0.00	0.07
225.0->247.5	0.05	0.05	0.00	0.00	0.00	0.10
247.5->270.0	0.10	0.00	0.00	0.00	0.00	0.10
270.0->292.5	0.05	0.00	0.00	0.00	0.00	0.05
292.5->315.0	0.00	0.00	0.00	0.00	0.00	0.00
315.0->337.5	0.07	0.05	0.00	0.00	0.00	0.12
337.5->360.0	0.05	0.07	0.00	0.00	0.00	0.12
SubTotal	0.77	0.31	0.05	0.00	0.00	1.13

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class B

Statistics Period - Start 1988 032JD 00:10 1988 February 01 00:10
End 1988 061JD 00:00 1988 March 01 00:00

4174 10min averages used for statistics.
4176 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.05	0.07	0.00	0.00	0.00	0.12
22.5-> 45.0	0.05	0.07	0.02	0.00	0.00	0.14
45.0-> 67.5	0.05	0.02	0.00	0.00	0.00	0.07
67.5-> 90.0	0.00	0.00	0.00	0.00	0.00	0.00
90.0->112.5	0.02	0.00	0.00	0.00	0.00	0.02
112.5->135.0	0.00	0.00	0.00	0.00	0.00	0.00
135.0->157.5	0.07	0.05	0.00	0.00	0.00	0.12
157.5->180.0	0.02	0.00	0.00	0.00	0.00	0.02
180.0->202.5	0.00	0.00	0.00	0.00	0.00	0.00
202.5->225.0	0.05	0.02	0.00	0.00	0.00	0.07
225.0->247.5	0.00	0.07	0.00	0.00	0.00	0.07
247.5->270.0	0.10	0.10	0.00	0.00	0.00	0.19
270.0->292.5	0.02	0.02	0.00	0.00	0.00	0.05
292.5->315.0	0.02	0.02	0.00	0.00	0.00	0.05
315.0->337.5	0.10	0.14	0.00	0.00	0.00	0.24
337.5->360.0	0.05	0.07	0.02	0.00	0.00	0.14
SubTotal	0.60	0.67	0.05	0.00	0.00	1.32

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class C

Statistics Period - Start 1988 032JD 00:10 1988 February 01 00:10
End 1988 061JD 00:00 1988 March 01 00:00

4174 10min averages used for statistics.
4176 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	1.34	0.26	0.00	0.00	0.00	1.61
22.5-> 45.0	0.31	0.19	0.02	0.00	0.00	0.53
45.0-> 67.5	0.22	0.00	0.00	0.00	0.00	0.22
67.5-> 90.0	0.14	0.02	0.00	0.00	0.00	0.17
90.0->112.5	0.05	0.02	0.00	0.00	0.00	0.07
112.5->135.0	0.02	0.10	0.00	0.00	0.00	0.12
135.0->157.5	0.07	0.17	0.00	0.00	0.00	0.24
157.5->180.0	0.34	0.02	0.05	0.00	0.00	0.41
180.0->202.5	0.12	0.12	0.07	0.00	0.00	0.31
202.5->225.0	0.12	0.10	0.14	0.00	0.00	0.36
225.0->247.5	0.10	0.14	0.05	0.00	0.00	0.29
247.5->270.0	0.19	0.38	0.07	0.00	0.00	0.65
270.0->292.5	0.19	0.19	0.31	0.00	0.00	0.69
292.5->315.0	0.36	0.02	0.19	0.00	0.00	0.57
315.0->337.5	0.36	0.22	0.05	0.00	0.00	0.62
337.5->360.0	0.67	1.25	0.07	0.00	0.00	1.99
SubTotal	4.60	3.21	1.03	0.00	0.00	8.84

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class D

Statistics Period - Start 1988 032JD 00:10 1988 February 01 00:10
End 1988 061JD 00:00 1988 March 01 00:00

4174 10min averages used for statistics.
4176 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	1.17	0.34	0.34	0.14	0.17	2.16
22.5-> 45.0	0.22	0.19	1.13	0.55	0.89	2.97
45.0-> 67.5	0.22	0.07	1.53	0.67	0.41	2.90
67.5-> 90.0	0.22	0.24	1.65	0.62	1.37	4.10
90.0->112.5	0.24	0.55	1.41	0.14	0.79	3.14
112.5->135.0	0.02	0.07	0.65	0.57	0.07	1.39
135.0->157.5	0.00	0.00	0.26	0.24	0.02	0.53
157.5->180.0	0.07	0.00	0.17	0.26	0.00	0.50
180.0->202.5	0.07	0.00	1.49	0.79	0.19	2.54
202.5->225.0	0.12	0.67	1.92	1.39	4.14	8.24
225.0->247.5	0.14	0.74	3.50	0.81	4.41	9.61
247.5->270.0	1.05	2.85	7.93	1.72	1.61	15.17
270.0->292.5	0.36	1.56	3.67	0.81	1.08	7.47
292.5->315.0	0.26	0.31	3.47	1.51	1.10	6.66
315.0->337.5	0.38	1.25	5.03	0.79	0.24	7.69
337.5->360.0	0.79	1.13	4.79	0.29	0.05	7.04
SubTotal	5.34	9.97	38.93	11.33	16.53	82.10

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class E

Statistics Period - Start 1988 032JD 00:10 1988 February 01 00:10
End 1988 061JD 00:00 1988 March 01 00:00

4174 10min averages used for statistics.
4176 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.02	0.12	0.10	0.00	0.00	0.24
22.5-> 45.0	0.00	0.12	0.24	0.00	0.00	0.36
45.0-> 67.5	0.00	0.02	0.00	0.00	0.00	0.02
67.5-> 90.0	0.02	0.00	0.00	0.00	0.00	0.02
90.0->112.5	0.00	0.02	0.02	0.00	0.00	0.05
112.5->135.0	0.00	0.10	0.05	0.00	0.00	0.14
135.0->157.5	0.00	0.07	0.00	0.00	0.00	0.07
157.5->180.0	0.00	0.00	0.12	0.00	0.00	0.12
180.0->202.5	0.07	0.05	0.05	0.00	0.00	0.17
202.5->225.0	0.14	0.22	0.07	0.00	0.00	0.43
225.0->247.5	0.12	0.24	0.10	0.00	0.00	0.46
247.5->270.0	0.22	0.79	0.22	0.00	0.00	1.22
270.0->292.5	0.07	0.24	0.02	0.00	0.00	0.34
292.5->315.0	0.12	0.12	0.00	0.00	0.00	0.24
315.0->337.5	0.24	0.53	0.12	0.00	0.00	0.89
337.5->360.0	0.02	0.14	0.12	0.00	0.00	0.29
SubTotal	1.05	2.78	1.22	0.00	0.00	5.06

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class F

Statistics Period - Start 1988 032JD 00:10 1988 February 01 00:10
End 1988 061JD 00:00 1988 March 01 00:00

4174 10min averages used for statistics.
4176 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.05	0.00	0.05	0.00	0.00	0.10
22.5-> 45.0	0.02	0.14	0.00	0.00	0.00	0.17
45.0-> 67.5	0.02	0.05	0.00	0.00	0.00	0.07
67.5-> 90.0	0.00	0.00	0.00	0.00	0.00	0.00
90.0->112.5	0.02	0.02	0.00	0.00	0.00	0.05
112.5->135.0	0.02	0.00	0.00	0.00	0.00	0.02
135.0->157.5	0.00	0.00	0.00	0.00	0.00	0.00
157.5->180.0	0.02	0.02	0.00	0.00	0.00	0.05
180.0->202.5	0.02	0.00	0.00	0.00	0.00	0.02
202.5->225.0	0.05	0.05	0.00	0.00	0.00	0.10
225.0->247.5	0.07	0.12	0.00	0.00	0.00	0.19
247.5->270.0	0.17	0.12	0.00	0.00	0.00	0.29
270.0->292.5	0.10	0.00	0.00	0.00	0.00	0.10
292.5->315.0	0.05	0.02	0.00	0.00	0.00	0.07
315.0->337.5	0.00	0.22	0.00	0.00	0.00	0.22
337.5->360.0	0.00	0.12	0.00	0.00	0.00	0.12
SubTotal	0.62	0.89	0.05	0.00	0.00	1.56

Table 14 Joint frequency distribution for Cherrywood, March 1988.

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class A

Statistics Period - Start 1988 061JD 00:10 1988 March 01 00:10
End 1988 092JD 00:00 1988 April 01 00:00

4463 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.25	0.07	0.02	0.00	0.00	0.34
22.5-> 45.0	0.18	0.11	0.00	0.00	0.00	0.29
45.0-> 67.5	0.09	0.13	0.00	0.00	0.00	0.22
67.5-> 90.0	0.09	0.13	0.00	0.00	0.00	0.22
90.0->112.5	0.27	0.09	0.02	0.00	0.00	0.38
112.5->135.0	0.22	0.20	0.29	0.00	0.00	0.72
135.0->157.5	0.07	0.18	0.49	0.00	0.00	0.74
157.5->180.0	0.07	0.07	0.02	0.00	0.00	0.16
180.0->202.5	0.22	0.07	0.04	0.00	0.00	0.34
202.5->225.0	0.16	0.09	0.07	0.00	0.00	0.31
225.0->247.5	0.18	0.34	0.00	0.00	0.00	0.52
247.5->270.0	0.34	0.29	0.00	0.00	0.00	0.63
270.0->292.5	0.31	0.20	0.02	0.00	0.00	0.54
292.5->315.0	0.20	0.20	0.04	0.00	0.00	0.45
315.0->337.5	0.29	0.16	0.00	0.00	0.00	0.45
337.5->360.0	0.16	0.04	0.00	0.00	0.00	0.20
SubTotal	3.09	2.38	1.03	0.00	0.00	6.50

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class B

Statistics Period - Start 1988 061JD 00:10 1988 March 01 00:10
End 1988 092JD 00:00 1988 April 01 00:00

4463 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.18	0.04	0.02	0.00	0.00	0.25
22.5-> 45.0	0.11	0.13	0.04	0.00	0.00	0.29
45.0-> 67.5	0.09	0.04	0.04	0.00	0.00	0.18
67.5-> 90.0	0.09	0.11	0.04	0.00	0.00	0.25
90.0->112.5	0.04	0.00	0.07	0.00	0.00	0.11
112.5->135.0	0.11	0.20	0.43	0.00	0.00	0.74
135.0->157.5	0.00	0.16	0.34	0.00	0.00	0.49
157.5->180.0	0.04	0.11	0.34	0.00	0.00	0.49
180.0->202.5	0.02	0.00	0.22	0.00	0.00	0.25
202.5->225.0	0.09	0.11	0.00	0.00	0.00	0.20
225.0->247.5	0.11	0.20	0.02	0.00	0.00	0.34
247.5->270.0	0.22	0.04	0.04	0.00	0.00	0.31
270.0->292.5	0.16	0.20	0.11	0.00	0.00	0.47
292.5->315.0	0.13	0.20	0.25	0.00	0.00	0.58
315.0->337.5	0.13	0.18	0.29	0.00	0.00	0.60
337.5->360.0	0.20	0.11	0.27	0.00	0.00	0.58
SubTotal	1.75	1.86	2.53	0.00	0.00	6.14

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class C

Statistics Period - Start 1988 061JD 00:10 1988 March 01 00:10
End 1988 092JD 00:00 1988 April 01 00:00

4463 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.45	0.11	0.36	0.00	0.00	0.92
22.5-> 45.0	0.74	0.00	0.02	0.00	0.00	0.76
45.0-> 67.5	0.72	0.04	0.00	0.00	0.00	0.76
67.5-> 90.0	0.29	0.02	0.00	0.00	0.00	0.31
90.0->112.5	0.18	0.09	0.18	0.07	0.00	0.52
112.5->135.0	0.20	0.11	0.27	0.11	0.00	0.69
135.0->157.5	0.27	0.07	0.29	0.00	0.00	0.63
157.5->180.0	0.13	0.07	0.34	0.00	0.00	0.54
180.0->202.5	0.27	0.13	0.38	0.00	0.00	0.78
202.5->225.0	0.38	0.13	0.13	0.00	0.00	0.65
225.0->247.5	0.67	0.07	0.09	0.00	0.00	0.83
247.5->270.0	0.38	0.09	0.27	0.00	0.00	0.74
270.0->292.5	0.16	0.25	0.27	0.00	0.00	0.67
292.5->315.0	0.13	0.09	0.99	0.02	0.00	1.23
315.0->337.5	0.07	0.25	1.77	0.07	0.00	2.15
337.5->360.0	0.25	0.25	1.03	0.02	0.00	1.55
SubTotal	5.29	1.77	6.39	0.29	0.00	13.74

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class D

Statistics Period - Start 1988 061JD 00:10 1988 March 01 00:10
End 1988 092JD 00:00 1988 April 01 00:00

4463 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.52	0.43	0.43	0.00	0.00	1.37
22.5-> 45.0	0.29	0.13	0.09	0.00	0.00	0.52
45.0-> 67.5	0.31	0.20	0.20	0.00	0.00	0.72
67.5-> 90.0	0.27	0.54	2.58	0.69	0.96	5.04
90.0->112.5	0.31	0.49	3.43	1.77	1.19	7.19
112.5->135.0	0.38	0.16	0.34	0.22	0.07	1.17
135.0->157.5	0.27	0.18	0.07	0.02	0.00	0.54
157.5->180.0	0.18	0.04	0.18	0.02	0.00	0.43
180.0->202.5	0.07	0.04	0.20	0.04	0.00	0.36
202.5->225.0	0.25	0.04	0.87	0.36	0.38	1.90
225.0->247.5	0.25	0.29	1.70	1.03	0.74	4.01
247.5->270.0	0.11	1.12	3.76	0.83	0.90	6.72
270.0->292.5	0.27	1.86	2.94	0.90	0.52	6.48
292.5->315.0	0.22	0.74	4.91	4.03	2.67	12.57
315.0->337.5	0.38	0.67	3.20	1.59	1.88	7.73
337.5->360.0	0.18	0.90	3.29	0.40	0.72	5.49
SubTotal	4.26	7.84	28.19	11.92	10.02	62.22

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class E

Statistics Period - Start 1988 061JD 00:10 1988 March 01 00:10
End 1988 092JD 00:00 1988 April 01 00:00

4463 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.04	0.04	0.00	0.00	0.00	0.09
22.5-> 45.0	0.00	0.04	0.00	0.00	0.00	0.04
45.0-> 67.5	0.04	0.20	0.20	0.00	0.00	0.45
67.5-> 90.0	0.11	0.16	0.16	0.00	0.00	0.43
90.0->112.5	0.13	0.36	0.18	0.00	0.00	0.67
112.5->135.0	0.13	0.07	0.07	0.00	0.00	0.27
135.0->157.5	0.00	0.00	0.04	0.00	0.00	0.04
157.5->180.0	0.00	0.00	0.04	0.00	0.00	0.04
180.0->202.5	0.04	0.04	0.18	0.00	0.00	0.27
202.5->225.0	0.00	0.07	0.04	0.00	0.00	0.11
225.0->247.5	0.00	0.18	0.54	0.00	0.00	0.72
247.5->270.0	0.20	0.81	0.11	0.00	0.00	1.12
270.0->292.5	0.49	1.46	0.16	0.00	0.00	2.11
292.5->315.0	0.09	0.78	0.09	0.00	0.00	0.96
315.0->337.5	0.13	0.47	0.02	0.00	0.00	0.63
337.5->360.0	0.07	0.11	0.00	0.00	0.00	0.18
SubTotal	1.50	4.79	1.84	0.00	0.00	8.13

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class F

Statistics Period - Start 1988 061JD 00:10 1988 March 01 00:10
End 1988 092JD 00:00 1988 April 01 00:00

4463 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.02	0.07	0.00	0.00	0.00	0.09
22.5-> 45.0	0.02	0.04	0.00	0.00	0.00	0.07
45.0-> 67.5	0.00	0.09	0.00	0.00	0.00	0.09
67.5-> 90.0	0.04	0.11	0.02	0.00	0.00	0.18
90.0->112.5	0.04	0.07	0.00	0.00	0.00	0.11
112.5->135.0	0.09	0.00	0.04	0.00	0.00	0.13
135.0->157.5	0.04	0.04	0.00	0.00	0.00	0.09
157.5->180.0	0.00	0.02	0.02	0.00	0.00	0.04
180.0->202.5	0.02	0.02	0.00	0.00	0.00	0.04
202.5->225.0	0.00	0.02	0.04	0.00	0.00	0.07
225.0->247.5	0.04	0.36	0.13	0.00	0.00	0.54
247.5->270.0	0.38	0.49	0.00	0.00	0.00	0.87
270.0->292.5	0.34	0.31	0.00	0.00	0.00	0.65
292.5->315.0	0.00	0.13	0.00	0.00	0.00	0.13
315.0->337.5	0.02	0.04	0.00	0.00	0.00	0.07
337.5->360.0	0.07	0.02	0.00	0.00	0.00	0.09
SubTotal	1.14	1.86	0.27	0.00	0.00	3.27

Table 15 Joint frequency distribution for Cherrywood, April 1988.

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class A

Statistics Period - Start 1988 092JD 00:10 1988 April 01 00:10
End 1988 122JD 00:00 1988 May 01 00:00

3997 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.10	0.15	0.08	0.00	0.00	0.33
22.5-> 45.0	0.15	0.43	0.13	0.00	0.00	0.70
45.0-> 67.5	0.23	0.15	0.05	0.00	0.00	0.43
67.5-> 90.0	0.23	0.03	0.05	0.00	0.00	0.30
90.0->112.5	0.18	0.28	0.05	0.00	0.00	0.50
112.5->135.0	0.28	0.73	0.55	0.00	0.00	1.55
135.0->157.5	0.38	0.90	1.45	0.00	0.00	2.73
157.5->180.0	0.18	0.43	0.35	0.00	0.00	0.95
180.0->202.5	0.23	0.10	0.03	0.00	0.00	0.35
202.5->225.0	0.08	0.20	0.03	0.00	0.00	0.30
225.0->247.5	0.25	0.05	0.03	0.00	0.00	0.33
247.5->270.0	0.15	0.08	0.00	0.00	0.00	0.23
270.0->292.5	0.15	0.05	0.00	0.00	0.00	0.20
292.5->315.0	0.13	0.08	0.00	0.00	0.00	0.20
315.0->337.5	0.08	0.13	0.00	0.00	0.00	0.20
337.5->360.0	0.18	0.13	0.03	0.00	0.00	0.33
SubTotal	2.93	3.88	2.80	0.00	0.00	9.61

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class B

Statistics Period - Start 1988 092JD 00:10 1988 April 01 00:10
End 1988 122JD 00:00 1988 May 01 00:00

3997 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.03	0.08	0.10	0.00	0.00	0.20
22.5-> 45.0	0.23	0.28	0.10	0.00	0.00	0.60
45.0-> 67.5	0.10	0.13	0.05	0.00	0.00	0.28
67.5-> 90.0	0.18	0.05	0.10	0.00	0.00	0.33
90.0->112.5	0.08	0.18	0.15	0.00	0.00	0.40
112.5->135.0	0.10	0.13	0.75	0.03	0.00	1.00
135.0->157.5	0.08	0.18	0.40	0.08	0.00	0.73
157.5->180.0	0.08	0.23	0.13	0.00	0.00	0.43
180.0->202.5	0.05	0.10	0.13	0.00	0.00	0.28
202.5->225.0	0.00	0.03	0.05	0.00	0.00	0.08
225.0->247.5	0.18	0.05	0.00	0.00	0.00	0.23
247.5->270.0	0.08	0.08	0.05	0.00	0.00	0.20
270.0->292.5	0.05	0.03	0.05	0.00	0.00	0.13
292.5->315.0	0.03	0.05	0.03	0.00	0.00	0.10
315.0->337.5	0.05	0.05	0.15	0.00	0.00	0.25
337.5->360.0	0.03	0.08	0.35	0.00	0.00	0.45
SubTotal	1.30	1.68	2.58	0.10	0.00	5.65

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class C

Statistics Period - Start 1988 092JD 00:10 1988 April 01 00:10
End 1988 122JD 00:00 1988 May 01 00:00

3997 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.78	0.13	0.10	0.00	0.00	1.00
22.5-> 45.0	0.55	0.43	0.23	0.00	0.00	1.20
45.0-> 67.5	0.45	0.23	0.20	0.00	0.00	0.88
67.5-> 90.0	0.50	0.20	0.15	0.00	0.00	0.85
90.0->112.5	0.25	0.33	0.50	0.00	0.03	1.10
112.5->135.0	0.15	0.10	0.40	0.08	0.13	0.85
135.0->157.5	0.33	0.15	0.08	0.00	0.00	0.55
157.5->180.0	0.25	0.15	0.18	0.03	0.00	0.60
180.0->202.5	0.03	0.05	0.23	0.03	0.00	0.33
202.5->225.0	0.25	0.00	0.15	0.03	0.00	0.43
225.0->247.5	0.20	0.00	0.03	0.03	0.00	0.25
247.5->270.0	0.35	0.10	0.20	0.03	0.00	0.68
270.0->292.5	0.38	0.03	0.20	0.00	0.00	0.60
292.5->315.0	0.15	0.05	0.43	0.28	0.03	0.93
315.0->337.5	0.05	0.13	0.98	0.78	0.10	2.03
337.5->360.0	0.75	0.45	0.50	0.25	0.00	1.95
SubTotal	5.40	2.50	4.53	1.50	0.28	14.21

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class D

Statistics Period - Start 1988 092JD 00:10 1988 April 01 00:10
End 1988 122JD 00:00 1988 May 01 00:00

3997 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.93	0.10	0.53	0.38	0.13	2.05
22.5-> 45.0	0.43	0.13	0.38	0.10	0.20	1.23
45.0-> 67.5	0.30	0.33	0.25	0.03	0.00	0.90
67.5-> 90.0	1.23	1.50	2.00	1.70	1.88	8.31
90.0->112.5	1.33	1.73	2.13	0.55	1.20	6.93
112.5->135.0	0.43	0.23	0.35	0.03	0.03	1.05
135.0->157.5	0.13	0.15	0.18	0.00	0.00	0.45
157.5->180.0	0.13	0.13	0.05	0.00	0.00	0.30
180.0->202.5	0.05	0.05	0.05	0.00	0.05	0.20
202.5->225.0	0.08	0.15	0.98	0.20	0.38	1.78
225.0->247.5	0.13	0.13	1.15	0.15	0.05	1.60
247.5->270.0	0.33	0.45	1.95	0.58	0.13	3.43
270.0->292.5	0.33	1.73	2.13	0.73	0.25	5.15
292.5->315.0	0.33	0.33	3.75	2.15	2.43	8.98
315.0->337.5	0.13	0.58	2.88	2.08	2.33	7.98
337.5->360.0	0.65	0.28	2.15	0.83	3.23	7.13
SubTotal	6.88	7.96	20.89	9.48	12.26	57.47

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class E

Statistics Period - Start 1988 092JD 00:10 1988 April 01 00:10
End 1988 122JD 00:00 1988 May 01 00:00

3997 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.13	0.10	0.15	0.00	0.00	0.38
22.5-> 45.0	0.13	0.08	0.08	0.00	0.00	0.28
45.0-> 67.5	0.18	0.25	0.05	0.00	0.00	0.48
67.5-> 90.0	0.33	0.80	0.18	0.00	0.00	1.30
90.0->112.5	0.13	0.03	0.00	0.00	0.00	0.15
112.5->135.0	0.03	0.10	0.00	0.00	0.00	0.13
135.0->157.5	0.00	0.08	0.00	0.00	0.00	0.08
157.5->180.0	0.00	0.10	0.03	0.00	0.00	0.13
180.0->202.5	0.00	0.08	0.03	0.00	0.00	0.10
202.5->225.0	0.03	0.05	0.20	0.00	0.00	0.28
225.0->247.5	0.15	0.15	0.13	0.00	0.00	0.43
247.5->270.0	0.35	0.75	0.10	0.00	0.00	1.20
270.0->292.5	0.55	0.98	0.08	0.00	0.00	1.60
292.5->315.0	0.25	0.60	0.35	0.00	0.00	1.20
315.0->337.5	0.13	0.50	0.10	0.00	0.00	0.73
337.5->360.0	0.13	0.60	0.58	0.00	0.00	1.30
SubTotal	2.48	5.23	2.03	0.00	0.00	9.73

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class F

Statistics Period - Start 1988 092JD 00:10 1988 April 01 00:10
End 1988 122JD 00:00 1988 May 01 00:00

3997 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.08	0.15	0.03	0.00	0.00	0.25
22.5-> 45.0	0.05	0.18	0.10	0.00	0.00	0.33
45.0-> 67.5	0.05	0.13	0.00	0.00	0.00	0.18
67.5-> 90.0	0.18	0.08	0.00	0.00	0.00	0.25
90.0->112.5	0.00	0.00	0.00	0.00	0.00	0.00
112.5->135.0	0.03	0.03	0.00	0.00	0.00	0.05
135.0->157.5	0.00	0.05	0.03	0.00	0.00	0.08
157.5->180.0	0.00	0.03	0.00	0.00	0.00	0.03
180.0->202.5	0.03	0.00	0.00	0.00	0.00	0.03
202.5->225.0	0.05	0.20	0.15	0.00	0.00	0.40
225.0->247.5	0.10	0.00	0.10	0.00	0.00	0.20
247.5->270.0	0.13	0.28	0.00	0.00	0.00	0.40
270.0->292.5	0.23	0.13	0.00	0.00	0.00	0.35
292.5->315.0	0.10	0.23	0.00	0.00	0.00	0.33
315.0->337.5	0.00	0.20	0.00	0.00	0.00	0.20
337.5->360.0	0.03	0.23	0.03	0.00	0.00	0.28
SubTotal	1.03	1.88	0.43	0.00	0.00	3.33

Table 16 Joint frequency distribution for Cherrywood, May 1988.

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class A

Statistics Period - Start 1988 122JD 00:10 1988 May 01 00:10
End 1988 153JD 00:00 1988 June 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.34	0.13	0.07	0.00	0.00	0.54
22.5-> 45.0	0.27	0.11	0.00	0.00	0.00	0.38
45.0-> 67.5	0.54	0.09	0.00	0.00	0.00	0.63
67.5-> 90.0	0.54	0.04	0.00	0.00	0.00	0.58
90.0->112.5	0.69	0.09	0.00	0.00	0.00	0.78
112.5->135.0	0.58	0.81	0.74	0.00	0.00	2.13
135.0->157.5	0.65	1.14	1.61	0.00	0.00	3.41
157.5->180.0	0.34	0.29	0.25	0.00	0.00	0.87
180.0->202.5	0.09	0.04	0.02	0.00	0.00	0.16
202.5->225.0	0.16	0.09	0.00	0.00	0.00	0.25
225.0->247.5	0.11	0.02	0.00	0.00	0.00	0.13
247.5->270.0	0.16	0.04	0.00	0.00	0.00	0.20
270.0->292.5	0.25	0.04	0.00	0.00	0.00	0.29
292.5->315.0	0.36	0.09	0.00	0.00	0.00	0.45
315.0->337.5	0.25	0.25	0.04	0.00	0.00	0.54
337.5->360.0	0.25	0.27	0.16	0.00	0.00	0.67
SubTotal	5.56	3.56	2.89	0.0(	0.00	12.01

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class B

Statistics Period - Start 1988 122JD 00:10 1988 May 01 00:10
End 1988 153JD 00:00 1988 June 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Directi n						
0.0-> 22.5	0.18	0.25	0.04	0.00	0.00	0.47
22.5-> 45.0	0.20	0.18	0.09	0.00	0.00	0.47
45.0-> 67.5	0.31	0.13	0.09	0.00	0.00	0.54
67.5-> 90.0	0.18	0.02	0.11	0.00	0.00	0.31
90.0->112.5	0.34	0.20	0.13	0.00	0.00	0.67
112.5->135.0	0.25	0.40	0.58	0.02	0.00	1.25
135.0->157.5	0.22	0.47	2.62	0.20	0.00	3.52
157.5->180.0	0.04	0.29	1.19	0.00	0.00	1.52
180.0->202.5	0.00	0.07	0.09	0.00	0.00	0.16
202.5->225.0	0.07	0.07	0.00	0.00	0.00	0.13
225.0->247.5	0.02	0.16	0.00	0.00	0.00	0.18
247.5->270.0	0.16	0.02	0.00	0.00	0.00	0.18
270.0->292.5	0.16	0.07	0.00	0.00	0.00	0.22
292.5->315.0	0.09	0.07	0.11	0.00	0.00	0.27
315.0->337.5	0.07	0.20	0.22	0.00	0.00	0.49
337.5->360.0	0.13	0.18	0.25	0.00	0.00	0.56
SubTotal	2.42	2.78	5.53	0.22	0.00	10.95

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class C

Statistics Period - Start 1988 122JD 00:10 1988 May 01 00:10
End 1988 153JD 00:00 1988 June 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	2.13	0.92	0.13	0.02	0.04	3.25
22.5-> 45.0	1.21	0.34	0.47	0.04	0.00	2.06
45.0-> 67.5	0.94	0.27	0.22	0.07	0.02	1.52
67.5-> 90.0	0.74	0.11	0.16	0.00	0.00	1.01
90.0->112.5	0.65	0.20	0.49	0.00	0.00	1.34
112.5->135.0	0.47	0.25	0.78	0.00	0.00	1.50
135.0->157.5	0.38	0.58	1.28	0.07	0.00	2.31
157.5->180.0	0.13	0.18	0.94	0.04	0.00	1.30
180.0->202.5	0.04	0.00	0.13	0.07	0.00	0.25
202.5->225.0	0.38	0.00	0.07	0.00	0.00	0.45
225.0->247.5	0.54	0.07	0.02	0.00	0.00	0.63
247.5->270.0	0.76	0.18	0.02	0.00	0.00	0.96
270.0->292.5	0.72	0.07	0.04	0.00	0.00	0.83
292.5->315.0	0.56	0.13	0.31	0.00	0.00	1.01
315.0->337.5	0.76	0.22	1.08	0.11	0.04	2.22
337.5->360.0	1.72	1.61	0.63	0.25	0.02	4.23
SubTotal	12.14	5.13	6.79	0.67	0.13	24.87

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class D

Statistics Period - Start 1988 122JD 00:10 1988 May 01 00:10
End 1988 153JD 00:00 1988 June 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	1.86	0.45	0.31	0.02	0.00	2.64
22.5-> 45.0	0.92	0.36	0.36	0.07	0.00	1.70
45.0-> 67.5	0.63	0.31	0.81	0.13	0.00	1.88
67.5-> 90.0	0.47	0.54	2.20	0.34	0.00	3.54
90.0->112.5	0.60	1.12	1.39	0.07	0.00	3.18
112.5->135.0	0.54	0.38	0.83	0.07	0.00	1.81
135.0->157.5	0.38	0.31	0.29	0.04	0.00	1.03
157.5->180.0	0.27	0.13	0.52	0.13	0.02	1.08
180.0->202.5	0.20	0.22	1.39	0.45	0.56	2.82
202.5->225.0	0.20	0.02	1.25	0.54	1.01	3.02
225.0->247.5	0.38	0.25	0.31	0.09	0.00	1.03
247.5->270.0	0.36	0.20	0.43	0.02	0.04	1.05
270.0->292.5	0.27	0.16	0.78	0.31	0.20	1.72
292.5->315.0	0.29	0.20	2.26	0.87	0.67	4.30
315.0->337.5	0.69	0.40	2.71	1.28	3.09	8.18
337.5->360.0	1.16	0.49	1.16	0.29	1.32	4.44
SubTotal	9.23	5.56	17.00	4.73	6.92	43.44

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class E

Statistics Period - Start 1988 122JD 00:10 1988 May 01 00:10
End 1988 153JD 00:00 1988 June 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.25	0.09	0.11	0.00	0.00	0.45
22.5-> 45.0	0.09	0.09	0.16	0.00	0.00	0.34
45.0-> 67.5	0.07	0.02	0.00	0.00	0.00	0.09
67.5-> 90.0	0.11	0.27	0.02	0.00	0.00	0.40
90.0->112.5	0.13	0.16	0.00	0.00	0.00	0.29
112.5->135.0	0.00	0.07	0.00	0.00	0.00	0.07
135.0->157.5	0.00	0.02	0.00	0.00	0.00	0.02
157.5->180.0	0.00	0.02	0.07	0.00	0.00	0.09
180.0->202.5	0.02	0.00	0.13	0.00	0.00	0.16
202.5->225.0	0.02	0.07	0.13	0.00	0.00	0.22
225.0->247.5	0.07	0.02	0.02	0.00	0.00	0.11
247.5->270.0	0.09	0.02	0.00	0.00	0.00	0.11
270.0->292.5	0.13	0.43	0.07	0.00	0.00	0.63
292.5->315.0	0.04	1.28	0.31	0.00	0.00	1.64
315.0->337.5	0.07	0.34	0.16	0.00	0.00	0.56
337.5->360.0	0.07	0.45	0.29	0.00	0.00	0.81
SubTotal	1.16	3.34	1.48	0.00	0.00	5.98

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class F

Statistics Period - Start 1988 122JD 00:10 1988 May 01 00:10
End 1988 153JD 00:00 1988 June 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.13	0.09	0.02	0.00	0.00	0.25
22.5-> 45.0	0.18	0.11	0.09	0.00	0.00	0.38
45.0-> 67.5	0.04	0.07	0.02	0.00	0.00	0.13
67.5-> 90.0	0.04	0.13	0.00	0.00	0.00	0.18
90.0->112.5	0.18	0.02	0.00	0.00	0.00	0.20
112.5->135.0	0.00	0.04	0.02	0.00	0.00	0.07
135.0->157.5	0.00	0.07	0.00	0.00	0.00	0.07
157.5->180.0	0.00	0.00	0.00	0.00	0.00	0.00
180.0->202.5	0.00	0.00	0.00	0.00	0.00	0.00
202.5->225.0	0.00	0.00	0.00	0.00	0.00	0.00
225.0->247.5	0.02	0.00	0.00	0.00	0.00	0.02
247.5->270.0	0.00	0.04	0.00	0.00	0.00	0.04
270.0->292.5	0.13	0.07	0.00	0.00	0.00	0.20
292.5->315.0	0.20	0.25	0.00	0.00	0.00	0.45
315.0->337.5	0.07	0.22	0.02	0.00	0.00	0.31
337.5->360.0	0.04	0.27	0.13	0.00	0.00	0.45
SubTotal	1.05	1.39	0.31	0.00	0.00	2.76

Table 17 Joint frequency distribution for Cherrywood, June 1988.

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class A

Statistics Period - Start 1988 153JD 00:10 1988 June 01 00:10
End 1988 183JD 00:00 1988 July 01 00:00

4320 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.07	0.14	0.00	0.00	0.00	0.21
22.5-> 45.0	0.02	0.05	0.00	0.00	0.00	0.07
45.0-> 67.5	0.09	0.00	0.00	0.00	0.00	0.09
67.5-> 90.0	0.05	0.00	0.00	0.00	0.00	0.05
90.0->112.5	0.23	0.05	0.00	0.00	0.00	0.28
112.5->135.0	0.35	0.07	0.00	0.00	0.00	0.42
135.0->157.5	0.21	0.12	0.05	0.00	0.00	0.37
157.5->180.0	0.16	0.07	0.00	0.00	0.00	0.23
180.0->202.5	0.19	0.02	0.00	0.00	0.00	0.21
202.5->225.0	0.07	0.07	0.00	0.00	0.00	0.14
225.0->247.5	0.09	0.07	0.00	0.00	0.00	0.16
247.5->270.0	0.19	0.00	0.00	0.00	0.00	0.19
270.0->292.5	0.60	0.21	0.00	0.00	0.00	0.81
292.5->315.0	0.14	0.09	0.00	0.00	0.00	0.23
315.0->337.5	0.12	0.12	0.00	0.00	0.00	0.23
337.5->360.0	0.16	0.28	0.02	0.00	0.00	0.46
SubTotal	2.73	1.34	0.07	0.00	0.00	4.14

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class B

Statistics Period - Start 1988 153JD 00:10 1988 June 01 00:10
End 1988 183JD 00:00 1988 July 01 00:00

4320 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.07	0.05	0.00	0.00	0.00	0.12
22.5-> 45.0	0.00	0.05	0.00	0.00	0.00	0.05
45.0-> 67.5	0.12	0.02	0.00	0.00	0.00	0.14
67.5-> 90.0	0.07	0.05	0.02	0.00	0.00	0.14
90.0->112.5	0.05	0.09	0.00	0.00	0.00	0.14
112.5->135.0	0.07	0.25	0.12	0.00	0.00	0.44
135.0->157.5	0.12	0.23	1.20	0.00	0.00	1.55
157.5->180.0	0.09	0.39	0.32	0.00	0.00	0.81
180.0->202.5	0.16	0.02	0.05	0.00	0.00	0.23
202.5->225.0	0.12	0.09	0.00	0.00	0.00	0.21
225.0->247.5	0.07	0.07	0.00	0.00	0.00	0.14
247.5->270.0	0.12	0.00	0.00	0.00	0.00	0.12
270.0->292.5	0.25	0.00	0.00	0.00	0.00	0.25
292.5->315.0	0.07	0.12	0.00	0.00	0.00	0.19
315.0->337.5	0.09	0.05	0.00	0.00	0.00	0.14
337.5->360.0	0.12	0.09	0.00	0.00	0.00	0.21
SubTotal	1.57	1.57	1.71	0.00	0.00	4.86

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class C

Statistics Period - Start 1988 153JD 00:10 1988 June 01 00:10
End 1988 183JD 00:00 1988 July 01 00:00

4320 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.42	0.09	0.25	0.00	0.00	0.76
22.5-> 45.0	0.16	0.21	0.02	0.00	0.00	0.39
45.0-> 67.5	0.23	0.07	0.16	0.00	0.00	0.46
67.5-> 90.0	0.19	0.05	0.14	0.00	0.00	0.37
90.0->112.5	0.25	0.05	0.00	0.00	0.00	0.30
112.5->135.0	0.23	0.28	0.23	0.00	0.00	0.74
135.0->157.5	0.16	0.21	0.88	0.00	0.00	1.25
157.5->180.0	0.19	0.07	1.44	0.00	0.00	1.69
180.0->202.5	0.16	0.09	0.51	0.00	0.00	0.76
202.5->225.0	0.16	0.00	0.02	0.00	0.00	0.19
225.0->247.5	0.35	0.05	0.00	0.00	0.00	0.39
247.5->270.0	0.65	0.12	0.00	0.00	0.00	0.76
270.0->292.5	1.11	0.07	0.00	0.00	0.00	1.18
292.5->315.0	0.56	0.12	0.23	0.00	0.00	0.90
315.0->337.5	0.39	0.23	0.86	0.00	0.00	1.48
337.5->360.0	0.79	0.19	1.04	0.07	0.00	2.08
SubTotal	6.00	1.88	5.79	0.07	0.00	13.73

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class D

Statistics Period - Start 1988 153JD 00:10 1988 June 01 00:10
End 1988 183JD 00:00 1988 July 01 00:00

4320 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.86	0.25	0.86	0.16	0.05	2.18
22.5-> 45.0	0.42	0.12	0.56	0.07	0.00	1.16
45.0-> 67.5	0.12	0.12	0.21	0.00	0.00	0.44
67.5-> 90.0	0.35	0.28	0.07	0.00	0.00	0.69
90.0->112.5	0.37	0.32	0.14	0.00	0.00	0.83
112.5->135.0	0.12	0.12	0.53	0.00	0.00	0.76
135.0->157.5	0.23	0.25	0.09	0.00	0.00	0.58
157.5->180.0	0.21	0.21	0.67	0.07	0.00	1.16
180.0->202.5	0.12	0.19	0.60	0.46	0.19	1.55
202.5->225.0	0.14	0.09	0.67	0.09	0.49	1.48
225.0->247.5	0.19	0.23	0.79	0.25	0.05	1.50
247.5->270.0	0.63	0.95	2.38	0.69	0.16	4.81
270.0->292.5	0.51	2.27	3.98	0.53	0.16	7.45
292.5->315.0	0.46	1.57	6.41	2.48	2.01	12.94
315.0->337.5	0.42	2.08	8.06	3.73	2.92	17.20
337.5->360.0	0.67	2.01	3.56	1.62	1.23	9.10
SubTotal	5.79	11.06	29.58	10.16	7.25	63.84

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class E

Statistics Period - Start 1988 153JD 00:10 1988 June 01 00:10
End 1988 183JD 00:00 1988 July 01 00:00

4320 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.00	0.14	0.23	0.00	0.00	0.37
22.5-> 45.0	0.07	0.02	0.49	0.00	0.00	0.58
45.0-> 67.5	0.02	0.02	0.00	0.00	0.00	0.05
67.5-> 90.0	0.12	0.09	0.00	0.00	0.00	0.21
90.0->112.5	0.05	0.05	0.00	0.00	0.00	0.09
112.5->135.0	0.00	0.02	0.00	0.00	0.00	0.02
135.0->157.5	0.00	0.00	0.00	0.00	0.00	0.00
157.5->180.0	0.07	0.00	0.00	0.00	0.00	0.07
180.0->202.5	0.00	0.00	0.02	0.00	0.00	0.02
202.5->225.0	0.00	0.00	0.05	0.00	0.00	0.05
225.0->247.5	0.02	0.28	0.23	0.00	0.00	0.53
247.5->270.0	0.35	0.67	0.00	0.00	0.00	1.02
270.0->292.5	0.56	1.09	0.02	0.00	0.00	1.67
292.5->315.0	0.12	1.32	0.16	0.00	0.00	1.60
315.0->337.5	0.49	1.09	0.12	0.00	0.00	1.69
337.5->360.0	0.19	1.37	0.30	0.00	0.00	1.85
SubTotal	2.04	6.16	1.62	0.00	0.00	9.81

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class F

Statistics Period - Start 1988 153JD 00:10 1988 June 01 00:10
End 1988 183JD 00:00 1988 July 01 00:00

4320 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.00	0.09	0.05	0.00	0.00	0.14
22.5-> 45.0	0.02	0.02	0.00	0.00	0.00	0.05
45.0-> 67.5	0.00	0.00	0.00	0.00	0.00	0.00
67.5-> 90.0	0.09	0.00	0.00	0.00	0.00	0.09
90.0->112.5	0.00	0.00	0.00	0.00	0.00	0.00
112.5->135.0	0.05	0.00	0.00	0.00	0.00	0.05
135.0->157.5	0.00	0.02	0.00	0.00	0.00	0.02
157.5->180.0	0.02	0.00	0.00	0.00	0.00	0.02
180.0->202.5	0.00	0.00	0.00	0.00	0.00	0.00
202.5->225.0	0.02	0.12	0.00	0.00	0.00	0.14
225.0->247.5	0.02	0.19	0.00	0.00	0.00	0.21
247.5->270.0	0.32	0.07	0.00	0.00	0.00	0.39
270.0->292.5	0.79	0.49	0.00	0.00	0.00	1.27
292.5->315.0	0.07	0.37	0.00	0.00	0.00	0.44
315.0->337.5	0.09	0.14	0.00	0.00	0.00	0.23
337.5->360.0	0.16	0.39	0.00	0.00	0.00	0.56
SubTotal	1.67	1.90	0.05	0.00	0.00	3.61

Table 18 Joint frequency distribution for Cherrywood, July 1988.

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class A

Statistics Period - Start 1988 183JD 00:10 1988 July 01 00:10
End 1988 214JD 00:00 1988 August 01 00:00

4463 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.29	0.02	0.00	0.00	0.00	0.31
22.5-> 45.0	0.43	0.18	0.00	0.00	0.00	0.60
45.0-> 67.5	0.16	0.04	0.00	0.00	0.00	0.20
67.5-> 90.0	0.16	0.02	0.00	0.00	0.00	0.18
90.0->112.5	0.52	0.20	0.02	0.00	0.00	0.74
112.5->135.0	0.56	0.74	0.38	0.00	0.00	1.68
135.0->157.5	0.78	1.37	0.60	0.00	0.00	2.76
157.5->180.0	0.38	0.31	0.40	0.00	0.00	1.10
180.0->202.5	0.40	0.13	0.02	0.00	0.00	0.56
202.5->225.0	0.40	0.02	0.00	0.00	0.00	0.43
225.0->247.5	0.47	0.02	0.00	0.00	0.00	0.49
247.5->270.0	0.58	0.00	0.00	0.00	0.00	0.58
270.0->292.5	0.31	0.00	0.00	0.00	0.00	0.31
292.5->315.0	0.27	0.02	0.00	0.00	0.00	0.29
315.0->337.5	0.47	0.18	0.00	0.00	0.00	0.65
337.5->360.0	0.56	0.52	0.00	0.00	0.00	1.08
SubTotal	6.74	3.79	1.43	0.00	0.00	11.97

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class B

Statistics Period - Start 1988 183JD 00:10 1988 July 01 00:10
End 1988 214JD 00:00 1988 August 01 00:00

4463 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.16	0.16	0.02	0.00	0.00	0.34
22.5-> 45.0	0.13	0.04	0.00	0.00	0.00	0.18
45.0-> 67.5	0.09	0.02	0.00	0.00	0.00	0.11
67.5-> 90.0	0.11	0.22	0.00	0.00	0.00	0.34
90.0->112.5	0.13	0.25	0.00	0.00	0.00	0.38
112.5->135.0	0.20	0.31	0.76	0.00	0.00	1.28
135.0->157.5	0.11	0.60	2.24	0.00	0.00	2.96
157.5->180.0	0.22	0.36	2.35	0.00	0.00	2.94
180.0->202.5	0.11	0.16	0.27	0.00	0.00	0.54
202.5->225.0	0.11	0.00	0.00	0.00	0.00	0.11
225.0->247.5	0.09	0.07	0.00	0.00	0.00	0.16
247.5->270.0	0.25	0.04	0.00	0.00	0.00	0.29
270.0->292.5	0.22	0.04	0.00	0.00	0.00	0.27
292.5->315.0	0.31	0.07	0.02	0.00	0.00	0.40
315.0->337.5	0.36	0.38	0.02	0.00	0.00	0.76
337.5->360.0	0.34	0.45	0.02	0.00	0.00	0.81
SubTotal	2.96	3.18	5.71	0.00	0.00	11.85

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class C

Statistics Period - Start 1988 183JD 00:10 1988 July 01 00:10
End 1988 214JD 00:00 1988 August 01 00:00

4463 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	3.02	0.25	0.00	0.00	0.00	3.27
22.5-> 45.0	1.10	0.11	0.00	0.00	0.00	1.21
45.0-> 67.5	0.60	0.22	0.00	0.00	0.00	0.83
67.5-> 90.0	0.38	0.29	0.00	0.00	0.00	0.67
90.0->112.5	0.38	0.16	0.04	0.00	0.00	0.58
112.5->135.0	0.34	0.25	0.52	0.00	0.00	1.10
135.0->157.5	0.47	0.54	0.83	0.00	0.00	1.84
157.5->180.0	0.45	0.38	1.39	0.18	0.00	2.40
180.0->202.5	0.45	0.07	0.20	0.00	0.00	0.72
202.5->225.0	0.56	0.04	0.07	0.00	0.00	0.67
225.0->247.5	0.72	0.13	0.09	0.00	0.00	0.94
247.5->270.0	0.90	0.04	0.00	0.00	0.00	0.94
270.0->292.5	1.01	0.04	0.02	0.00	0.00	1.08
292.5->315.0	1.61	0.60	0.40	0.00	0.00	2.62
315.0->337.5	2.35	0.85	1.03	0.00	0.00	4.23
337.5->360.0	4.57	1.48	0.45	0.00	0.00	6.50
SubTotal	18.91	5.47	5.04	0.18	0.00	29.60

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class D

Statistics Period - Start 1988 183JD 00:10 1988 July 01 00:10
End 1988 214JD 00:00 1988 August 01 00:00

4463 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	3.00	0.25	0.18	0.09	0.02	3.54
22.5-> 45.0	0.94	0.58	0.09	0.02	0.00	1.64
45.0-> 67.5	0.76	0.43	0.09	0.00	0.00	1.28
67.5-> 90.0	0.60	0.16	0.07	0.00	0.00	0.83
90.0->112.5	0.52	0.00	0.00	0.00	0.00	0.52
112.5->135.0	0.49	0.22	0.02	0.00	0.00	0.74
135.0->157.5	0.49	0.13	0.18	0.00	0.00	0.81
157.5->180.0	0.60	0.40	0.22	0.04	0.02	1.30
180.0->202.5	0.43	0.25	0.11	0.04	0.00	0.83
202.5->225.0	0.56	0.27	0.36	0.11	0.09	1.39
225.0->247.5	0.45	0.49	1.01	0.16	0.00	2.11
247.5->270.0	0.69	0.76	0.94	0.18	0.02	2.60
270.0->292.5	1.12	0.72	0.78	0.04	0.02	2.69
292.5->315.0	0.87	1.05	1.64	0.07	0.00	3.63
315.0->337.5	1.23	2.02	4.55	0.58	0.45	8.83
337.5->360.0	1.99	1.12	1.57	0.47	0.67	5.83
SubTotal	14.77	8.85	11.81	1.81	1.30	38.54

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class E

Statistics Period - Start 1988 183JD 00:10 1988 July 01 00:10
End 1988 214JD 00:00 1988 August 01 00:00

4463 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.07	0.11	0.02	0.00	0.00	0.20
22.5-> 45.0	0.07	0.20	0.00	0.00	0.00	0.27
45.0-> 67.5	0.04	0.00	0.00	0.00	0.00	0.04
67.5-> 90.0	0.00	0.00	0.02	0.00	0.00	0.02
90.0->112.5	0.02	0.00	0.00	0.00	0.00	0.02
112.5->135.0	0.04	0.00	0.00	0.00	0.00	0.04
135.0->157.5	0.00	0.04	0.00	0.00	0.00	0.04
157.5->180.0	0.07	0.00	0.00	0.00	0.00	0.07
180.0->202.5	0.11	0.02	0.04	0.00	0.00	0.18
202.5->225.0	0.04	0.02	0.00	0.00	0.00	0.07
225.0->247.5	0.18	0.49	0.04	0.00	0.00	0.72
247.5->270.0	0.31	0.38	0.00	0.00	0.00	0.69
270.0->292.5	0.22	0.13	0.00	0.00	0.00	0.36
292.5->315.0	0.25	0.38	0.00	0.00	0.00	0.63
315.0->337.5	0.20	0.56	0.09	0.00	0.00	0.85
337.5->360.0	0.27	0.85	0.04	0.00	0.00	1.17
SubTotal	1.90	3.20	0.27	0.00	0.00	5.38

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class F

Statistics Period - Start 1988 183JD 00:10 1988 July 01 00:10
End 1988 214JD 00:00 1988 August 01 00:00

4463 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.04	0.07	0.00	0.00	0.00	0.11
22.5-> 45.0	0.04	0.07	0.00	0.00	0.00	0.11
45.0-> 67.5	0.02	0.00	0.00	0.00	0.00	0.02
67.5-> 90.0	0.07	0.00	0.00	0.00	0.00	0.07
90.0->112.5	0.00	0.00	0.00	0.00	0.00	0.00
112.5->135.0	0.07	0.02	0.00	0.00	0.00	0.09
135.0->157.5	0.02	0.09	0.00	0.00	0.00	0.11
157.5->180.0	0.00	0.02	0.00	0.00	0.00	0.02
180.0->202.5	0.02	0.16	0.00	0.00	0.00	0.18
202.5->225.0	0.09	0.02	0.00	0.00	0.00	0.11
225.0->247.5	0.07	0.13	0.00	0.00	0.00	0.20
247.5->270.0	0.16	0.09	0.00	0.00	0.00	0.25
270.0->292.5	0.16	0.02	0.00	0.00	0.00	0.18
292.5->315.0	0.13	0.04	0.00	0.00	0.00	0.18
315.0->337.5	0.13	0.31	0.00	0.00	0.00	0.45
337.5->360.0	0.29	0.27	0.02	0.00	0.00	0.58
SubTotal	1.32	1.32	0.02	0.00	0.00	2.67

Table 19 Joint frequency distribution for Cherrywood, August 1988.

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class A

Statistics Period - Start 1988 214JD 00:10 1988 August 01 00:10
End 1988 245JD 00:00 1988 September 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.20	0.09	0.00	0.00	0.00	0.29
22.5-> 45.0	0.16	0.16	0.00	0.00	0.00	0.31
45.0-> 67.5	0.16	0.04	0.00	0.00	0.00	0.20
67.5-> 90.0	0.36	0.04	0.00	0.00	0.00	0.40
90.0->112.5	0.29	0.09	0.02	0.00	0.00	0.40
112.5->135.0	0.40	0.47	0.13	0.00	0.00	1.01
135.0->157.5	0.36	0.56	0.34	0.00	0.00	1.25
157.5->180.0	0.36	0.45	0.34	0.00	0.00	1.14
180.0->202.5	0.31	0.27	0.07	0.00	0.00	0.65
202.5->225.0	0.25	0.09	0.00	0.00	0.00	0.34
225.0->247.5	0.27	0.02	0.00	0.00	0.00	0.29
247.5->270.0	0.22	0.00	0.00	0.00	0.00	0.22
270.0->292.5	0.09	0.00	0.00	0.00	0.00	0.09
292.5->315.0	0.11	0.04	0.00	0.00	0.00	0.16
315.0->337.5	0.16	0.07	0.00	0.00	0.00	0.22
337.5->360.0	0.27	0.31	0.00	0.00	0.00	0.58
SubTotal	3.97	2.71	0.90	0.00	0.00	7.57

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class B

Statistics Period - Start 1988 214JD 00:10 1988 August 01 00:10
End 1988 245JD 00:00 1988 September 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.02	0.18	0.04	0.00	0.00	0.25
22.5-> 45.0	0.09	0.11	0.00	0.00	0.00	0.20
45.0-> 67.5	0.11	0.20	0.00	0.00	0.00	0.31
67.5-> 90.0	0.11	0.07	0.00	0.00	0.00	0.18
90.0->112.5	0.22	0.22	0.07	0.00	0.00	0.52
112.5->135.0	0.09	0.22	0.85	0.00	0.00	1.16
135.0->157.5	0.09	0.45	1.34	0.00	0.00	1.88
157.5->180.0	0.07	0.38	1.08	0.00	0.00	1.52
180.0->202.5	0.09	0.22	0.47	0.00	0.00	0.78
202.5->225.0	0.13	0.22	0.02	0.00	0.00	0.38
225.0->247.5	0.13	0.11	0.00	0.00	0.00	0.25
247.5->270.0	0.34	0.20	0.00	0.00	0.00	0.54
270.0->292.5	0.29	0.13	0.00	0.00	0.00	0.43
292.5->315.0	0.29	0.13	0.00	0.00	0.00	0.43
315.0->337.5	0.34	0.11	0.00	0.00	0.00	0.45
337.5->360.0	0.27	0.40	0.09	0.00	0.00	0.76
SubTotal	2.69	3.38	3.97	0.00	0.00	10.04

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class C

Statistics Period - Start 1988 214JD 00:10 1988 August 01 00:10
End 1988 245JD 00:00 1988 September 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	2.35	0.13	0.25	0.00	0.00	2.73
22.5-> 45.0	2.22	0.13	0.04	0.00	0.00	2.40
45.0-> 67.5	0.78	0.02	0.00	0.00	0.00	0.81
67.5-> 90.0	0.27	0.02	0.00	0.00	0.00	0.29
90.0->112.5	0.34	0.04	0.02	0.00	0.00	0.40
112.5->135.0	0.31	0.11	0.36	0.00	0.00	0.78
135.0->157.5	0.25	0.16	0.69	0.00	0.00	1.10
157.5->180.0	0.60	0.40	1.68	0.04	0.00	2.73
180.0->202.5	0.34	0.31	1.25	0.52	0.00	2.42
202.5->225.0	0.31	0.22	0.40	0.02	0.00	0.96
225.0->247.5	0.47	0.16	0.13	0.00	0.00	0.76
247.5->270.0	0.54	0.16	0.20	0.00	0.00	0.90
270.0->292.5	0.92	0.47	0.31	0.00	0.00	1.70
292.5->315.0	0.81	0.36	0.60	0.00	0.00	1.77
315.0->337.5	1.30	0.52	0.69	0.00	0.00	2.51
337.5->360.0	3.09	0.52	0.67	0.00	0.00	4.28
SubTotal	14.90	3.74	7.33	0.58	0.00	26.55

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class D

Statistics Period - Start 1988 214JD 00:10 1988 August 01 00:10
End 1988 245JD 00:00 1988 September 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	2.80	0.27	0.07	0.04	0.00	3.18
22.5-> 45.0	1.46	0.11	0.27	0.00	0.00	1.84
45.0-> 67.5	0.74	0.00	0.00	0.00	0.00	0.74
67.5-> 90.0	0.38	0.00	0.07	0.02	0.02	0.49
90.0->112.5	0.78	0.38	1.23	0.29	0.02	2.71
112.5->135.0	0.76	0.22	0.67	0.07	0.00	1.72
135.0->157.5	0.52	0.07	0.09	0.00	0.00	0.67
157.5->180.0	0.72	0.31	0.09	0.04	0.00	1.16
180.0->202.5	0.52	0.49	0.92	0.81	0.52	3.25
202.5->225.0	0.47	0.60	1.95	0.67	0.72	4.41
225.0->247.5	0.52	0.94	2.11	0.56	0.38	4.50
247.5->270.0	0.74	1.08	1.50	0.58	0.04	3.94
270.0->292.5	1.37	0.76	0.96	0.43	0.40	3.92
292.5->315.0	0.81	0.99	0.90	0.25	0.36	3.29
315.0->337.5	1.10	1.32	1.72	0.31	0.58	5.04
337.5->360.0	2.53	0.67	0.52	0.13	0.07	3.92
SubTotal	16.20	8.22	13.06	4.21	3.11	44.80

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class E

Statistics Period - Start 1988 214JD 00:10 1988 August 01 00:10
End 1988 245JD 00:00 1988 September 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.07	0.29	0.04	0.00	0.00	0.40
22.5-> 45.0	0.16	0.18	0.07	0.00	0.00	0.40
45.0-> 67.5	0.00	0.00	0.00	0.00	0.00	0.00
67.5-> 90.0	0.09	0.04	0.02	0.00	0.00	0.16
90.0->112.5	0.09	0.04	0.00	0.00	0.00	0.13
112.5->135.0	0.04	0.02	0.00	0.00	0.00	0.07
135.0->157.5	0.00	0.07	0.00	0.00	0.00	0.07
157.5->180.0	0.02	0.04	0.00	0.00	0.00	0.07
180.0->202.5	0.07	0.16	0.02	0.00	0.00	0.25
202.5->225.0	0.09	0.56	0.07	0.00	0.00	0.72
225.0->247.5	0.25	0.54	0.04	0.00	0.00	0.83
247.5->270.0	0.31	0.20	0.00	0.00	0.00	0.52
270.0->292.5	0.56	0.11	0.00	0.00	0.00	0.67
292.5->315.0	0.27	0.63	0.04	0.00	0.00	0.94
315.0->337.5	0.27	1.12	0.00	0.00	0.00	1.39
337.5->360.0	0.13	0.87	0.13	0.00	0.00	1.14
SubTotal	2.42	4.88	0.45	0.00	0.00	7.75

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class F

Statistics Period - Start 1988 214JD 00:10 1988 August 01 00:10
End 1988 245JD 00:00 1988 September 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.02	0.13	0.02	0.00	0.00	0.18
22.5-> 45.0	0.11	0.40	0.00	0.00	0.00	0.52
45.0-> 67.5	0.00	0.11	0.00	0.00	0.00	0.11
67.5-> 90.0	0.02	0.09	0.00	0.00	0.00	0.11
90.0->112.5	0.02	0.00	0.00	0.00	0.00	0.02
112.5->135.0	0.00	0.00	0.00	0.00	0.00	0.00
135.0->157.5	0.02	0.02	0.00	0.00	0.00	0.04
157.5->180.0	0.00	0.04	0.00	0.00	0.00	0.04
180.0->202.5	0.02	0.04	0.00	0.00	0.00	0.07
202.5->225.0	0.16	0.11	0.00	0.00	0.00	0.27
225.0->247.5	0.11	0.09	0.00	0.00	0.00	0.20
247.5->270.0	0.09	0.00	0.00	0.00	0.00	0.09
270.0->292.5	0.22	0.02	0.00	0.00	0.00	0.25
292.5->315.0	0.22	0.02	0.00	0.00	0.00	0.25
315.0->337.5	0.16	0.27	0.02	0.00	0.00	0.45
337.5->360.0	0.13	0.54	0.02	0.00	0.00	0.69
SubTotal	1.32	1.90	0.07	0.00	0.00	3.29

Table 20 Joint frequency distribution for Cherrywood, September 1988.

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class A

Statistics Period - Start 1988 245JD 00:10 1988 September 01 00:10
End 1988 275JD 00:00 1988 October 01 00:00

4320 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.09	0.00	0.00	0.00	0.00	0.09
22.5-> 45.0	0.14	0.12	0.00	0.00	0.00	0.25
45.0-> 67.5	0.14	0.05	0.00	0.00	0.00	0.19
67.5-> 90.0	0.12	0.02	0.00	0.00	0.00	0.14
90.0->112.5	0.07	0.00	0.00	0.00	0.00	0.07
112.5->135.0	0.07	0.00	0.00	0.00	0.00	0.07
135.0->157.5	0.16	0.07	0.00	0.00	0.00	0.23
157.5->180.0	0.12	0.05	0.00	0.00	0.00	0.16
180.0->202.5	0.07	0.05	0.00	0.00	0.00	0.12
202.5->225.0	0.09	0.02	0.00	0.00	0.00	0.12
225.0->247.5	0.19	0.07	0.00	0.00	0.00	0.25
247.5->270.0	0.16	0.00	0.00	0.00	0.00	0.16
270.0->292.5	0.16	0.00	0.00	0.00	0.00	0.16
292.5->315.0	0.14	0.00	0.00	0.00	0.00	0.14
315.0->337.5	0.07	0.05	0.00	0.00	0.00	0.12
337.5->360.0	0.07	0.09	0.00	0.00	0.00	0.16
SubTotal	1.85	0.58	0.00	0.00	0.00	2.43

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class B

Statistics Period - Start 1988 245JD 00:10 1988 September 01 00:10
End 1988 275JD 00:00 1988 October 01 00:00

4320 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.05	0.14	0.02	0.00	0.00	0.21
22.5-> 45.0	0.07	0.14	0.00	0.00	0.00	0.21
45.0-> 67.5	0.02	0.02	0.00	0.00	0.00	0.05
67.5-> 90.0	0.12	0.05	0.00	0.00	0.00	0.16
90.0->112.5	0.07	0.07	0.00	0.00	0.00	0.14
112.5->135.0	0.12	0.05	0.09	0.00	0.00	0.25
135.0->157.5	0.12	0.28	0.19	0.00	0.00	0.58
157.5->180.0	0.09	0.51	0.39	0.00	0.00	1.00
180.0->202.5	0.14	0.23	0.16	0.00	0.00	0.53
202.5->225.0	0.07	0.07	0.00	0.00	0.00	0.14
225.0->247.5	0.12	0.02	0.00	0.00	0.00	0.14
247.5->270.0	0.32	0.02	0.00	0.00	0.00	0.35
270.0->292.5	0.23	0.02	0.00	0.00	0.00	0.25
292.5->315.0	0.05	0.00	0.00	0.00	0.00	0.05
315.0->337.5	0.07	0.00	0.00	0.00	0.00	0.07
337.5->360.0	0.14	0.21	0.02	0.00	0.00	0.37
SubTotal	1.78	1.83	0.88	0.00	0.00	4.49

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class C

Statistics Period - Start 1988 245JD 00:10 1988 September 01 00:10
End 1988 275JD 00:00 1988 October 01 00:00

4320 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	1.48	0.46	0.25	0.00	0.00	2.20
22.5-> 45.0	1.37	0.14	0.39	0.00	0.00	1.90
45.0-> 67.5	0.97	0.07	0.14	0.00	0.00	1.18
67.5-> 90.0	0.65	0.02	0.02	0.00	0.00	0.69
90.0->112.5	0.44	0.09	0.07	0.00	0.00	0.60
112.5->135.0	0.53	0.19	0.53	0.00	0.00	1.25
135.0->157.5	0.37	0.25	0.79	0.00	0.00	1.41
157.5->180.0	0.86	0.32	1.62	0.00	0.00	2.80
180.0->202.5	0.53	0.35	0.90	0.02	0.00	1.81
202.5->225.0	0.56	0.14	0.07	0.00	0.00	0.76
225.0->247.5	0.74	0.25	0.09	0.00	0.00	1.09
247.5->270.0	0.67	0.53	0.09	0.00	0.00	1.30
270.0->292.5	0.67	0.46	0.16	0.00	0.00	1.30
292.5->315.0	0.65	0.37	0.21	0.00	0.00	1.23
315.0->337.5	0.56	0.69	0.25	0.00	0.00	1.50
337.5->360.0	1.50	0.79	0.53	0.00	0.00	2.82
SubTotal	12.55	5.14	6.13	0.02	0.00	23.84

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class D

Statistics Period - Start 1988 245JD 00:10 1988 September 01 00:10
End 1988 275JD 00:00 1988 October 01 00:00

4320 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	3.17	0.12	0.42	0.02	0.00	3.73
22.5-> 45.0	0.93	0.05	0.21	0.05	0.00	1.23
45.0-> 67.5	0.97	0.21	0.14	0.00	0.00	1.32
67.5-> 90.0	1.30	1.02	2.22	0.07	0.16	4.77
90.0->112.5	0.95	1.62	1.53	0.83	0.37	5.30
112.5->135.0	0.79	1.34	0.79	0.07	0.07	3.06
135.0->157.5	0.60	0.56	0.44	0.07	0.00	1.67
157.5->180.0	0.69	0.72	0.74	0.09	0.00	2.25
180.0->202.5	0.21	0.35	1.25	1.06	0.16	3.03
202.5->225.0	0.58	0.37	1.27	0.35	0.51	3.08
225.0->247.5	0.51	0.74	1.83	0.58	0.28	3.94
247.5->270.0	0.74	1.27	1.69	0.16	0.05	3.91
270.0->292.5	1.30	2.29	1.64	0.30	0.07	5.60
292.5->315.0	1.23	1.83	3.22	2.15	1.32	9.75
315.0->337.5	0.67	0.46	1.44	1.06	1.16	4.79
337.5->360.0	1.99	0.28	0.30	0.02	0.07	2.66
SubTotal	16.62	13.22	19.12	6.90	4.21	60.07

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class E

Statistics Period - Start 1988 245JD 00:10 1988 September 01 00:10
End 1988 275JD 00:00 1988 October 01 00:00

4320 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.00	0.02	0.00	0.00	0.00	0.02
22.5-> 45.0	0.02	0.12	0.09	0.00	0.00	0.23
45.0-> 67.5	0.05	0.16	0.16	0.00	0.00	0.37
67.5-> 90.0	0.05	0.09	0.00	0.00	0.00	0.14
90.0->112.5	0.02	0.00	0.00	0.00	0.00	0.02
112.5->135.0	0.14	0.07	0.00	0.00	0.00	0.21
135.0->157.5	0.07	0.09	0.00	0.00	0.00	0.16
157.5->180.0	0.09	0.09	0.00	0.00	0.00	0.19
180.0->202.5	0.05	0.07	0.19	0.00	0.00	0.30
202.5->225.0	0.00	0.09	0.07	0.00	0.00	0.16
225.0->247.5	0.05	0.19	0.00	0.00	0.00	0.23
247.5->270.0	0.83	0.42	0.00	0.00	0.00	1.25
270.0->292.5	0.86	1.09	0.00	0.00	0.00	1.94
292.5->315.0	0.30	0.65	0.02	0.00	0.00	0.97
315.0->337.5	0.00	0.12	0.02	0.00	0.00	0.14
337.5->360.0	0.00	0.37	0.02	0.00	0.00	0.39
SubTotal	2.52	3.63	0.58	0.00	0.00	6.74

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class F

Statistics Period - Start 1988 245JD 00:10 1988 September 01 00:10
End 1988 275JD 00:00 1988 October 01 00:00

4320 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.02	0.12	0.00	0.00	0.00	0.14
22.5-> 45.0	0.00	0.09	0.00	0.00	0.00	0.09
45.0-> 67.5	0.02	0.07	0.00	0.00	0.00	0.09
67.5-> 90.0	0.05	0.00	0.00	0.00	0.00	0.05
90.0->112.5	0.00	0.00	0.00	0.00	0.00	0.00
112.5->135.0	0.07	0.02	0.00	0.00	0.00	0.09
135.0->157.5	0.00	0.02	0.00	0.00	0.00	0.02
157.5->180.0	0.00	0.05	0.00	0.00	0.00	0.05
180.0->202.5	0.00	0.02	0.02	0.00	0.00	0.05
202.5->225.0	0.00	0.09	0.00	0.00	0.00	0.09
225.0->247.5	0.05	0.14	0.00	0.00	0.00	0.19
247.5->270.0	0.53	0.07	0.00	0.00	0.00	0.60
270.0->292.5	0.42	0.19	0.00	0.00	0.00	0.60
292.5->315.0	0.09	0.07	0.00	0.00	0.00	0.16
315.0->337.5	0.00	0.05	0.00	0.00	0.00	0.05
337.5->360.0	0.05	0.12	0.00	0.00	0.00	0.16
SubTotal	1.30	1.11	0.02	0.00	0.00	2.43

Table 21 Joint frequency distribution for Cherrywood, October 1988.

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class A

Statistics Period - Start 1988 275JD 00:10 1988 October 01 00:10
End 1988 306JD 00:00 1988 November 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.11	0.00	0.00	0.00	0.00	0.11
22.5-> 45.0	0.13	0.13	0.00	0.00	0.00	0.27
45.0-> 67.5	0.29	0.18	0.00	0.00	0.00	0.47
67.5-> 90.0	0.09	0.04	0.00	0.00	0.00	0.13
90.0->112.5	0.09	0.02	0.00	0.00	0.00	0.11
112.5->135.0	0.22	0.04	0.00	0.00	0.00	0.27
135.0->157.5	0.25	0.02	0.00	0.00	0.00	0.27
157.5->180.0	0.04	0.00	0.00	0.00	0.00	0.04
180.0->202.5	0.07	0.02	0.00	0.00	0.00	0.09
202.5->225.0	0.09	0.00	0.00	0.00	0.00	0.09
225.0->247.5	0.07	0.02	0.00	0.00	0.00	0.09
247.5->270.0	0.16	0.02	0.00	0.00	0.00	0.18
270.0->292.5	0.00	0.00	0.00	0.00	0.00	0.00
292.5->315.0	0.11	0.02	0.00	0.00	0.00	0.13
315.0->337.5	0.20	0.00	0.00	0.00	0.00	0.20
337.5->360.0	0.27	0.13	0.00	0.00	0.00	0.40
SubTotal	2.20	0.67	0.00	0.00	0.00	2.87

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class B

Statistics Period - Start 1988 275JD 00:10 1988 October 01 00:10
End 1988 306JD 00:00 1988 November 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.22	0.09	0.07	0.00	0.00	0.38
22.5-> 45.0	0.09	0.07	0.00	0.00	0.00	0.16
45.0-> 67.5	0.09	0.11	0.00	0.00	0.00	0.20
67.5-> 90.0	0.16	0.13	0.00	0.00	0.00	0.29
90.0->112.5	0.13	0.18	0.00	0.00	0.00	0.31
112.5->135.0	0.11	0.07	0.00	0.00	0.00	0.18
135.0->157.5	0.09	0.09	0.07	0.00	0.00	0.25
157.5->180.0	0.02	0.07	0.02	0.00	0.00	0.11
180.0->202.5	0.02	0.11	0.02	0.00	0.00	0.16
202.5->225.0	0.11	0.09	0.00	0.00	0.00	0.20
225.0->247.5	0.11	0.04	0.00	0.00	0.00	0.16
247.5->270.0	0.16	0.09	0.00	0.00	0.00	0.25
270.0->292.5	0.16	0.00	0.00	0.00	0.00	0.16
292.5->315.0	0.20	0.02	0.00	0.00	0.00	0.22
315.0->337.5	0.18	0.02	0.00	0.00	0.00	0.20
337.5->360.0	0.13	0.29	0.00	0.00	0.00	0.43
SubTotal	1.99	1.48	0.18	0.00	0.00	3.65

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class C

Statistics Period - Start 1988 275JD 00:10 1988 October 01 00:10
End 1988 306JD 00:00 1988 November 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	1.28	0.38	0.11	0.00	0.00	1.77
22.5-> 45.0	1.10	0.29	0.09	0.00	0.00	1.48
45.0-> 67.5	1.14	0.18	0.13	0.00	0.00	1.46
67.5-> 90.0	0.29	0.04	0.18	0.00	0.00	0.52
90.0->112.5	0.31	0.18	0.22	0.00	0.00	0.72
112.5->135.0	0.11	0.18	0.16	0.02	0.00	0.47
135.0->157.5	0.18	0.09	0.31	0.00	0.00	0.58
157.5->180.0	0.16	0.07	0.67	0.04	0.00	0.94
180.0->202.5	0.25	0.20	0.69	0.00	0.00	1.14
202.5->225.0	0.38	0.18	0.20	0.00	0.00	0.76
225.0->247.5	0.31	0.20	0.31	0.00	0.00	0.83
247.5->270.0	0.45	0.04	0.04	0.00	0.00	0.54
270.0->292.5	0.69	0.07	0.04	0.00	0.00	0.81
292.5->315.0	0.54	0.18	0.07	0.00	0.00	0.78
315.0->337.5	0.58	0.07	0.13	0.00	0.00	0.78
337.5->360.0	1.64	1.01	0.02	0.00	0.00	2.67
SubTotal	9.41	3.36	3.41	0.07	0.00	16.24

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class D

Statistics Period - Start 1988 275JD 00:10 1988 October 01 00:10
End 1988 306JD 00:00 1988 November 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	2.40	0.52	0.63	0.13	0.00	3.67
22.5-> 45.0	0.81	0.45	0.76	0.02	0.02	2.06
45.0-> 67.5	0.43	0.27	0.56	0.00	0.02	1.28
67.5-> 90.0	0.11	0.31	0.43	0.07	0.00	0.92
90.0->112.5	0.52	0.94	1.28	0.07	0.00	2.80
112.5->135.0	0.29	0.45	1.48	0.16	0.02	2.40
135.0->157.5	0.22	0.40	1.21	0.07	0.16	2.06
157.5->180.0	0.29	0.85	1.41	0.22	0.07	2.84
180.0->202.5	0.25	0.31	2.60	0.74	0.43	4.32
202.5->225.0	0.49	0.22	1.99	1.93	1.30	5.94
225.0->247.5	0.38	0.69	2.87	1.88	1.43	7.26
247.5->270.0	0.34	1.37	4.93	1.21	1.72	9.57
270.0->292.5	1.03	2.17	2.17	0.60	0.72	6.70
292.5->315.0	0.58	0.65	3.18	1.55	0.76	6.72
315.0->337.5	0.67	1.30	1.95	0.54	0.11	4.57
337.5->360.0	2.08	1.03	1.43	0.18	0.00	4.73
SubTotal	10.89	11.94	28.88	9.36	6.77	67.83

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class E

Statistics Period - Start 1988 275JD 00:10 1988 October 01 00:10
End 1988 306JD 00:00 1988 November 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.11	0.16	0.00	0.00	0.00	0.27
22.5-> 45.0	0.11	0.43	0.02	0.00	0.00	0.56
45.0-> 67.5	0.07	0.29	0.02	0.00	0.00	0.38
67.5-> 90.0	0.07	0.07	0.00	0.00	0.00	0.13
90.0->112.5	0.02	0.09	0.00	0.00	0.00	0.11
112.5->135.0	0.00	0.02	0.00	0.00	0.00	0.02
135.0->157.5	0.00	0.04	0.00	0.00	0.00	0.04
157.5->180.0	0.07	0.11	0.00	0.00	0.00	0.18
180.0->202.5	0.04	0.07	0.02	0.00	0.00	0.13
202.5->225.0	0.00	0.07	0.02	0.00	0.00	0.09
225.0->247.5	0.02	0.38	0.09	0.00	0.00	0.49
247.5->270.0	0.31	0.63	0.00	0.00	0.00	0.94
270.0->292.5	0.90	0.60	0.00	0.00	0.00	1.50
292.5->315.0	0.11	0.34	0.00	0.00	0.00	0.45
315.0->337.5	0.29	0.13	0.04	0.00	0.00	0.47
337.5->360.0	0.22	0.29	0.02	0.00	0.00	0.54
SubTotal	2.35	3.72	0.25	0.00	0.00	6.32

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class F

Statistics Period - Start 1988 275JD 00:10 1988 October 01 00:10
End 1988 306JD 00:00 1988 November 01 00:00

4464 10min averages used for statistics.
4464 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.09	0.04	0.00	0.00	0.00	0.13
22.5-> 45.0	0.07	0.18	0.00	0.00	0.00	0.25
45.0-> 67.5	0.09	0.49	0.00	0.00	0.00	0.58
67.5-> 90.0	0.02	0.13	0.00	0.00	0.00	0.16
90.0->112.5	0.18	0.04	0.00	0.00	0.00	0.22
112.5->135.0	0.00	0.04	0.00	0.00	0.00	0.04
135.0->157.5	0.00	0.00	0.00	0.00	0.00	0.00
157.5->180.0	0.02	0.02	0.00	0.00	0.00	0.04
180.0->202.5	0.00	0.02	0.00	0.00	0.00	0.02
202.5->225.0	0.07	0.02	0.00	0.00	0.00	0.09
225.0->247.5	0.02	0.13	0.00	0.00	0.00	0.16
247.5->270.0	0.27	0.13	0.00	0.00	0.00	0.40
270.0->292.5	0.43	0.00	0.00	0.00	0.00	0.43
292.5->315.0	0.04	0.07	0.00	0.00	0.00	0.11
315.0->337.5	0.13	0.00	0.00	0.00	0.00	0.13
337.5->360.0	0.11	0.20	0.00	0.00	0.00	0.31
SubTotal	1.55	1.55	0.00	0.00	0.00	3.09

Table 22 Joint frequency distribution for Cherrywood, November 1988.

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class A

Statistics Period - Start 1988 306JD 00:10 1988 November 01 00:10
End 1988 336JD 00:00 1988 December 01 00:00

4320 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.07	0.00	0.00	0.00	0.00	0.07
22.5-> 45.0	0.16	0.07	0.00	0.00	0.00	0.23
45.0-> 67.5	0.12	0.00	0.00	0.00	0.00	0.12
67.5-> 90.0	0.07	0.05	0.00	0.00	0.00	0.12
90.0->112.5	0.00	0.00	0.00	0.00	0.00	0.00
112.5->135.0	0.12	0.05	0.00	0.00	0.00	0.16
135.0->157.5	0.12	0.02	0.00	0.00	0.00	0.14
157.5->180.0	0.12	0.09	0.00	0.00	0.00	0.21
180.0->202.5	0.21	0.02	0.00	0.00	0.00	0.23
202.5->225.0	0.07	0.00	0.00	0.00	0.00	0.07
225.0->247.5	0.07	0.00	0.00	0.00	0.00	0.07
247.5->270.0	0.05	0.00	0.00	0.00	0.00	0.05
270.0->292.5	0.05	0.00	0.00	0.00	0.00	0.05
292.5->315.0	0.21	0.00	0.00	0.00	0.00	0.21
315.0->337.5	0.02	0.00	0.00	0.00	0.00	0.02
337.5->360.0	0.14	0.09	0.00	0.00	0.00	0.23
SubTotal	1.57	0.39	0.00	0.00	0.00	1.97

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class B

Statistics Period - Start 1988 306JD 00:10 1988 November 01 00:10
End 1988 336JD 00:00 1988 December 01 00:00

4320 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.05	0.02	0.00	0.00	0.00	0.07
22.5-> 45.0	0.02	0.00	0.00	0.00	0.00	0.02
45.0-> 67.5	0.07	0.09	0.00	0.00	0.00	0.16
67.5-> 90.0	0.00	0.00	0.00	0.00	0.00	0.00
90.0->112.5	0.02	0.00	0.00	0.00	0.00	0.02
112.5->135.0	0.02	0.00	0.00	0.00	0.00	0.02
135.0->157.5	0.14	0.05	0.05	0.00	0.00	0.23
157.5->180.0	0.07	0.09	0.02	0.00	0.00	0.19
180.0->202.5	0.12	0.16	0.05	0.00	0.00	0.32
202.5->225.0	0.14	0.05	0.02	0.00	0.00	0.21
225.0->247.5	0.05	0.12	0.00	0.00	0.00	0.16
247.5->270.0	0.09	0.07	0.00	0.00	0.00	0.16
270.0->292.5	0.07	0.00	0.00	0.00	0.00	0.07
292.5->315.0	0.05	0.00	0.00	0.00	0.00	0.05
315.0->337.5	0.14	0.02	0.00	0.00	0.00	0.16
337.5->360.0	0.12	0.16	0.00	0.00	0.00	0.28
SubTotal	1.16	0.83	0.14	0.00	0.00	2.13

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class C

Statistics Period - Start 1988 306JD 00:10 1988 November 01 00:10
End 1988 336JD 00:00 1988 December 01 00:00

4320 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	1.25	0.07	0.00	0.00	0.00	1.32
22.5-> 45.0	1.18	0.05	0.00	0.00	0.00	1.23
45.0-> 67.5	1.13	0.14	0.00	0.00	0.00	1.27
67.5-> 90.0	0.37	0.19	0.00	0.00	0.00	0.56
90.0->112.5	0.23	0.12	0.16	0.00	0.00	0.51
112.5->135.0	0.39	0.09	0.16	0.00	0.00	0.65
135.0->157.5	0.35	0.21	0.14	0.00	0.00	0.69
157.5->180.0	0.32	0.16	0.16	0.00	0.00	0.65
180.0->202.5	0.32	0.02	0.23	0.00	0.00	0.58
202.5->225.0	0.23	0.12	0.05	0.00	0.00	0.39
225.0->247.5	0.25	0.02	0.02	0.00	0.00	0.30
247.5->270.0	0.19	0.05	0.12	0.00	0.00	0.35
270.0->292.5	0.19	0.07	0.02	0.00	0.00	0.28
292.5->315.0	0.37	0.00	0.00	0.00	0.00	0.37
315.0->337.5	0.79	0.09	0.05	0.00	0.00	0.93
337.5->360.0	1.64	0.14	0.00	0.00	0.00	1.78
SubTotal	9.21	1.53	1.11	0.00	0.00	11.85

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class D

Statistics Period - Start 1988 306JD 00:10 1988 November 01 00:10
End 1988 336JD 00:00 1988 December 01 00:00

4320 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	1.02	0.19	0.21	0.07	0.00	1.48
22.5-> 45.0	0.53	0.05	0.39	0.21	0.02	1.20
45.0-> 67.5	0.53	0.21	0.28	0.00	0.00	1.02
67.5-> 90.0	1.32	1.55	1.90	0.56	1.18	6.50
90.0->112.5	1.37	2.94	3.50	1.20	0.63	9.63
112.5->135.0	1.02	1.02	3.08	0.32	0.02	5.46
135.0->157.5	0.65	0.97	1.53	0.12	0.00	3.26
157.5->180.0	0.44	0.39	0.56	0.09	0.12	1.60
180.0->202.5	0.32	0.44	1.25	0.39	0.35	2.75
202.5->225.0	0.72	0.30	1.25	0.53	1.53	4.33
225.0->247.5	0.86	1.97	2.04	1.02	4.35	10.23
247.5->270.0	1.06	2.38	6.11	1.76	1.23	12.55
270.0->292.5	0.30	1.06	1.69	0.72	0.30	4.07
292.5->315.0	0.44	0.51	3.94	1.20	1.13	7.22
315.0->337.5	0.39	0.16	0.65	1.13	1.83	4.17
337.5->360.0	1.11	0.19	0.44	0.05	0.14	1.92
SubTotal	12.08	14.33	28.80	9.38	12.82	77.41

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class E

Statistics Period - Start 1988 306JD 00:10 1988 November 01 00:10
End 1988 336JD 00:00 1988 December 01 00:00

4320 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.07	0.00	0.00	0.00	0.00	0.07
22.5-> 45.0	0.19	0.05	0.00	0.00	0.00	0.23
45.0-> 67.5	0.23	0.53	0.12	0.00	0.00	0.88
67.5-> 90.0	0.21	0.46	0.23	0.00	0.00	0.90
90.0->112.5	0.14	0.16	0.00	0.00	0.00	0.30
112.5->135.0	0.16	0.21	0.09	0.00	0.00	0.46
135.0->157.5	0.16	0.25	0.07	0.00	0.00	0.49
157.5->180.0	0.07	0.14	0.12	0.00	0.00	0.32
180.0->202.5	0.07	0.07	0.00	0.00	0.00	0.14
202.5->225.0	0.14	0.02	0.02	0.00	0.00	0.19
225.0->247.5	0.23	0.09	0.00	0.00	0.00	0.32
247.5->270.0	0.25	0.19	0.02	0.00	0.00	0.46
270.0->292.5	0.16	0.00	0.00	0.00	0.00	0.16
292.5->315.0	0.09	0.02	0.00	0.00	0.00	0.12
315.0->337.5	0.09	0.07	0.00	0.00	0.00	0.16
337.5->360.0	0.05	0.12	0.00	0.00	0.00	0.16
SubTotal	2.31	2.38	0.67	0.00	0.00	5.37

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class F

Statistics Period - Start 1988 306JD 00:10 1988 November 01 00:10
End 1988 336JD 00:00 1988 December 01 00:00

4320 10min averages used for statistics.
4320 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.05	0.00	0.00	0.00	0.00	0.05
22.5-> 45.0	0.02	0.05	0.00	0.00	0.00	0.07
45.0-> 67.5	0.09	0.09	0.00	0.00	0.00	0.19
67.5-> 90.0	0.12	0.07	0.00	0.00	0.00	0.19
90.0->112.5	0.00	0.02	0.00	0.00	0.00	0.02
112.5->135.0	0.05	0.02	0.00	0.00	0.00	0.07
135.0->157.5	0.07	0.02	0.00	0.00	0.00	0.09
157.5->180.0	0.12	0.05	0.00	0.00	0.00	0.16
180.0->202.5	0.02	0.05	0.00	0.00	0.00	0.07
202.5->225.0	0.05	0.00	0.00	0.00	0.00	0.05
225.0->247.5	0.07	0.00	0.00	0.00	0.00	0.07
247.5->270.0	0.12	0.00	0.00	0.00	0.00	0.12
270.0->292.5	0.02	0.00	0.00	0.00	0.00	0.02
292.5->315.0	0.02	0.00	0.00	0.00	0.00	0.02
315.0->337.5	0.00	0.02	0.00	0.00	0.00	0.02
337.5->360.0	0.02	0.05	0.00	0.00	0.00	0.07
SubTotal	0.83	0.44	0.00	0.00	0.00	1.27

Table 23 Joint frequency distribution for Cherrywood, December 1988.

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class A

Statistics Period - Start 1988 336JD 00:10 1988 December 01 00:10
End 1988 366JD 23:50 1988 December 31 23:50

4463 10min averages used for statistics.
4463 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.13	0.00	0.00	0.00	0.00	0.13
22.5-> 45.0	0.09	0.04	0.00	0.00	0.00	0.13
45.0-> 67.5	0.04	0.00	0.00	0.00	0.00	0.04
67.5-> 90.0	0.02	0.00	0.00	0.00	0.00	0.02
90.0->112.5	0.04	0.00	0.00	0.00	0.00	0.04
112.5->135.0	0.09	0.00	0.00	0.00	0.00	0.09
135.0->157.5	0.00	0.00	0.00	0.00	0.00	0.00
157.5->180.0	0.07	0.02	0.00	0.00	0.00	0.09
180.0->202.5	0.04	0.07	0.00	0.00	0.00	0.11
202.5->225.0	0.09	0.02	0.00	0.00	0.00	0.11
225.0->247.5	0.13	0.02	0.02	0.00	0.00	0.18
247.5->270.0	0.11	0.04	0.00	0.00	0.00	0.16
270.0->292.5	0.13	0.00	0.00	0.00	0.00	0.13
292.5->315.0	0.00	0.00	0.00	0.00	0.00	0.00
315.0->337.5	0.09	0.02	0.00	0.00	0.00	0.11
337.5->360.0	0.09	0.00	0.00	0.00	0.00	0.09
SubTotal	1.19	0.25	0.02	0.00	0.00	1.46

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class B

Statistics Period - Start 1988 336JD 00:10 1988 December 01 00:10
End 1988 366JD 23:50 1988 December 31 23:50

4463 10min averages used for statistics.
4463 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.09	0.02	0.00	0.00	0.00	0.11
22.5-> 45.0	0.02	0.00	0.00	0.00	0.00	0.02
45.0-> 67.5	0.02	0.00	0.00	0.00	0.00	0.02
67.5-> 90.0	0.09	0.00	0.00	0.00	0.00	0.09
90.0->112.5	0.04	0.00	0.00	0.00	0.00	0.04
112.5->135.0	0.07	0.04	0.00	0.00	0.00	0.11
135.0->157.5	0.04	0.00	0.00	0.00	0.00	0.04
157.5->180.0	0.09	0.00	0.00	0.00	0.00	0.09
180.0->202.5	0.13	0.04	0.02	0.00	0.00	0.20
202.5->225.0	0.09	0.11	0.00	0.00	0.00	0.20
225.0->247.5	0.09	0.02	0.00	0.00	0.00	0.11
247.5->270.0	0.47	0.04	0.00	0.00	0.00	0.52
270.0->292.5	0.13	0.02	0.00	0.00	0.00	0.16
292.5->315.0	0.13	0.00	0.00	0.00	0.00	0.13
315.0->337.5	0.04	0.02	0.00	0.00	0.00	0.07
337.5->360.0	0.16	0.02	0.00	0.00	0.00	0.18
SubTotal	1.73	0.36	0.02	0.00	0.00	2.11

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class C

Statistics Period - Start 1988 336JD 00:10 1988 December 01 00:10
End 1988 366JD 23:50 1988 December 31 23:50

4463 10min averages used for statistics.
4463 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.92	0.00	0.20	0.00	0.00	1.12
22.5-> 45.0	0.67	0.02	0.20	0.00	0.00	0.90
45.0-> 67.5	0.34	0.13	0.02	0.00	0.00	0.49
67.5-> 90.0	0.16	0.09	0.11	0.00	0.00	0.36
90.0->112.5	0.31	0.11	0.04	0.00	0.00	0.47
112.5->135.0	0.16	0.07	0.00	0.00	0.00	0.22
135.0->157.5	0.18	0.04	0.00	0.00	0.00	0.22
157.5->180.0	0.27	0.07	0.20	0.00	0.00	0.54
180.0->202.5	0.25	0.11	0.02	0.00	0.00	0.38
202.5->225.0	0.18	0.02	0.04	0.00	0.00	0.25
225.0->247.5	0.81	0.07	0.07	0.00	0.00	0.94
247.5->270.0	1.05	0.20	0.20	0.00	0.00	1.46
270.0->292.5	0.40	0.13	0.11	0.00	0.00	0.65
292.5->315.0	0.52	0.09	0.09	0.00	0.00	0.69
315.0->337.5	0.27	0.04	0.22	0.00	0.00	0.54
337.5->360.0	0.40	0.00	0.18	0.02	0.00	0.60
SubTotal	6.88	1.21	1.73	0.02	0.00	9.84

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class D

Statistics Period - Start 1988 336JD 00:10 1988 December 01 00:10
End 1988 366JD 23:50 1988 December 31 23:50

4463 10min averages used for statistics.
4463 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	1.55	0.72	0.94	0.07	0.02	3.29
22.5-> 45.0	0.94	1.12	0.38	0.00	0.00	2.44
45.0-> 67.5	0.58	0.85	0.43	0.00	0.00	1.86
67.5-> 90.0	0.18	0.22	1.12	0.74	0.43	2.69
90.0->112.5	0.11	0.11	0.29	0.27	0.52	1.30
112.5->135.0	0.07	0.04	0.34	0.52	0.83	1.79
135.0->157.5	0.16	0.09	0.43	0.11	0.07	0.85
157.5->180.0	0.09	0.11	1.46	0.27	0.09	2.02
180.0->202.5	0.20	0.52	1.59	0.43	0.07	2.80
202.5->225.0	0.16	1.10	2.02	0.69	1.99	5.96
225.0->247.5	0.72	1.59	4.55	2.06	3.43	12.35
247.5->270.0	0.99	3.29	6.70	2.42	3.02	16.42
270.0->292.5	0.52	1.39	3.16	1.46	1.59	8.11
292.5->315.0	0.27	1.10	2.67	1.57	1.14	6.74
315.0->337.5	0.49	0.69	2.85	0.81	1.37	6.21
337.5->360.0	1.55	1.25	1.55	0.29	0.31	4.95
SubTotal	8.56	14.21	30.45	11.70	14.88	79.79

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class E

Statistics Period - Start 1988 336JD 00:10 1988 December 01 00:10
End 1988 366JD 23:50 1988 December 31 23:50

4463 10min averages used for statistics.
4463 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.31	0.07	0.00	0.00	0.00	0.38
22.5-> 45.0	0.04	0.11	0.00	0.00	0.00	0.16
45.0-> 67.5	0.07	0.09	0.00	0.00	0.00	0.16
67.5-> 90.0	0.09	0.00	0.00	0.00	0.00	0.09
90.0->112.5	0.00	0.02	0.00	0.00	0.00	0.02
112.5->135.0	0.02	0.00	0.04	0.00	0.00	0.07
135.0->157.5	0.00	0.00	0.04	0.00	0.00	0.04
157.5->180.0	0.00	0.16	0.11	0.00	0.00	0.27
180.0->202.5	0.07	0.04	0.11	0.00	0.00	0.22
202.5->225.0	0.02	0.29	0.49	0.00	0.00	0.81
225.0->247.5	0.13	0.43	0.11	0.00	0.00	0.67
247.5->270.0	0.29	0.67	0.00	0.00	0.00	0.96
270.0->292.5	0.38	0.04	0.00	0.00	0.00	0.43
292.5->315.0	0.04	0.29	0.00	0.00	0.00	0.34
315.0->337.5	0.04	0.02	0.02	0.00	0.00	0.09
337.5->360.0	0.22	0.07	0.02	0.00	0.00	0.31
SubTotal	1.75	2.31	0.96	0.00	0.00	5.02

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class F

Statistics Period - Start 1988 336JD 00:10 1988 December 01 00:10
End 1988 366JD 23:50 1988 December 31 23:50

4463 10min averages used for statistics.
4463 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.11	0.00	0.00	0.00	0.00	0.11
22.5-> 45.0	0.00	0.02	0.00	0.00	0.00	0.02
45.0-> 67.5	0.02	0.00	0.00	0.00	0.00	0.02
67.5-> 90.0	0.07	0.00	0.00	0.00	0.00	0.07
90.0->112.5	0.02	0.00	0.00	0.00	0.00	0.02
112.5->135.0	0.00	0.00	0.04	0.00	0.00	0.04
135.0->157.5	0.00	0.02	0.13	0.00	0.00	0.16
157.5->180.0	0.02	0.02	0.00	0.00	0.00	0.04
180.0->202.5	0.02	0.04	0.02	0.00	0.00	0.09
202.5->225.0	0.09	0.07	0.00	0.00	0.00	0.16
225.0->247.5	0.13	0.11	0.04	0.00	0.00	0.29
247.5->270.0	0.20	0.09	0.00	0.00	0.00	0.29
270.0->292.5	0.11	0.02	0.00	0.00	0.00	0.13
292.5->315.0	0.02	0.04	0.00	0.00	0.00	0.07
315.0->337.5	0.04	0.07	0.00	0.00	0.00	0.11
337.5->360.0	0.07	0.09	0.00	0.00	0.00	0.16
SubTotal	0.94	0.60	0.25	0.00	0.00	1.79

Table 24 Joint frequency distribution for Cherrywood, 1988.

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class A

Statistics Period - Start 1988 001JD 00:10 1988 January 01 00:10
End 1988 366JD 23:50 1988 December 31 23:50

52376 10min averages used for statistics.
52703 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.15	0.05	0.02	0.00	0.00	0.22
22.5-> 45.0	0.18	0.13	0.01	0.00	0.00	0.32
45.0-> 67.5	0.17	0.06	0.00	0.00	0.00	0.24
67.5-> 90.0	0.16	0.04	0.01	0.00	0.00	0.20
90.0->112.5	0.21	0.07	0.01	0.00	0.00	0.29
112.5->135.0	0.24	0.26	0.17	0.00	0.00	0.68
135.0->157.5	0.26	0.38	0.38	0.00	0.00	1.02
157.5->180.0	0.15	0.15	0.12	0.00	0.00	0.42
180.0->202.5	0.18	0.08	0.02	0.00	0.00	0.28
202.5->225.0	0.16	0.06	0.01	0.00	0.00	0.22
225.0->247.5	0.18	0.08	0.00	0.00	0.00	0.26
247.5->270.0	0.22	0.04	0.00	0.00	0.00	0.26
270.0->292.5	0.20	0.04	0.00	0.00	0.00	0.24
292.5->315.0	0.15	0.05	0.00	0.00	0.00	0.21
315.0->337.5	0.16	0.09	0.00	0.00	0.00	0.25
337.5->360.0	0.19	0.16	0.02	0.00	0.00	0.37
SubTotal	2.95	1.75	0.77	0.00	0.00	5.47

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class B

Statistics Period - Start 1988 001JD 00:10 1988 January 01 00:10
End 1988 366JD 23:50 1988 December 31 23:50

52376 10min averages used for statistics.
52703 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.09	0.09	0.03	0.00	0.00	0.21
22.5-> 45.0	0.09	0.09	0.02	0.00	0.00	0.20
45.0-> 67.5	0.09	0.07	0.02	0.00	0.00	0.18
67.5-> 90.0	0.09	0.06	0.03	0.00	0.00	0.19
90.0->112.5	0.10	0.10	0.03	0.00	0.00	0.24
112.5->135.0	0.10	0.15	0.30	0.00	0.00	0.55
135.0->157.5	0.09	0.23	0.72	0.02	0.00	1.06
157.5->180.0	0.07	0.23	0.50	0.00	0.00	0.81
180.0->202.5	0.09	0.12	0.14	0.00	0.00	0.35
202.5->225.0	0.10	0.08	0.01	0.00	0.00	0.19
225.0->247.5	0.09	0.09	0.00	0.00	0.00	0.18
247.5->270.0	0.21	0.07	0.01	0.00	0.00	0.28
270.0->292.5	0.15	0.05	0.01	0.00	0.00	0.21
292.5->315.0	0.13	0.07	0.03	0.00	0.00	0.23
315.0->337.5	0.14	0.10	0.06	0.00	0.00	0.30
337.5->360.0	0.15	0.18	0.08	0.00	0.00	0.41
SubTotal	1.78	1.77	2.01	0.03	0.00	5.58

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class C

Statistics Period - Start 1988 001JD 00:10 1988 January 01 00:10
End 1988 366JD 23:50 1988 December 31 23:50

52376 10min averages used for statistics.
52703 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	1.35	0.24	0.14	0.00	0.00	1.73
22.5-> 45.0	0.91	0.17	0.12	0.00	0.00	1.21
45.0-> 67.5	0.64	0.12	0.07	0.01	0.00	0.84
67.5-> 90.0	0.34	0.09	0.08	0.00	0.00	0.50
90.0->112.5	0.29	0.12	0.14	0.01	0.00	0.56
112.5->135.0	0.25	0.15	0.28	0.02	0.01	0.71
135.0->157.5	0.27	0.22	0.45	0.01	0.00	0.95
157.5->180.0	0.32	0.17	0.74	0.03	0.00	1.26
180.0->202.5	0.25	0.13	0.41	0.06	0.00	0.85
202.5->225.0	0.31	0.10	0.15	0.01	0.00	0.56
225.0->247.5	0.46	0.10	0.10	0.00	0.00	0.66
247.5->270.0	0.54	0.16	0.12	0.00	0.00	0.82
270.0->292.5	0.61	0.16	0.12	0.00	0.00	0.89
292.5->315.0	0.56	0.17	0.30	0.02	0.00	1.05
315.0->337.5	0.69	0.30	0.62	0.07	0.01	1.70
337.5->360.0	1.53	0.64	0.45	0.05	0.00	2.68
SubTotal	9.31	3.04	4.31	0.28	0.03	16.98

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class D

Statistics Period - Start 1988 001JD 00:10 1988 January 01 00:10
End 1988 366JD 23:50 1988 December 31 23:50

52376 10min averages used for statistics.
52703 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	1.70	0.37	0.49	0.10	0.03	2.69
22.5-> 45.0	0.69	0.29	0.38	0.09	0.09	1.54
45.0-> 67.5	0.49	0.29	0.39	0.07	0.03	1.27
67.5-> 90.0	0.57	0.55	1.20	0.41	0.53	3.26
90.0->112.5	0.63	0.85	1.42	0.46	0.44	3.80
112.5->135.0	0.42	0.36	0.82	0.18	0.09	1.88
135.0->157.5	0.32	0.26	0.41	0.08	0.02	1.10
157.5->180.0	0.32	0.28	0.56	0.11	0.03	1.30
180.0->202.5	0.24	0.27	1.16	0.52	0.27	2.47
202.5->225.0	0.35	0.37	1.57	0.79	1.37	4.45
225.0->247.5	0.41	0.74	2.52	1.01	1.42	6.10
247.5->270.0	0.61	1.39	3.51	1.03	1.38	7.92
270.0->292.5	0.65	1.35	2.04	0.58	0.49	5.11
292.5->315.0	0.50	0.80	3.12	1.57	1.28	7.28
315.0->337.5	0.59	0.97	3.00	1.27	1.40	7.23
337.5->360.0	1.31	0.86	1.87	0.45	0.66	5.14
SubTotal	9.81	10.02	24.45	8.72	9.54	62.54

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class E

Statistics Period - Start 1988 001JD 00:10 1988 January 01 00:10
End 1988 366JD 23:50 1988 December 31 23:50

52376 10min averages used for statistics.
52703 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.10	0.10	0.05	0.00	0.00	0.25
22.5-> 45.0	0.08	0.13	0.09	0.00	0.00	0.30
45.0-> 67.5	0.07	0.13	0.05	0.00	0.00	0.25
67.5-> 90.0	0.10	0.16	0.05	0.00	0.00	0.32
90.0->112.5	0.06	0.08	0.02	0.00	0.00	0.16
112.5->135.0	0.06	0.06	0.02	0.00	0.00	0.14
135.0->157.5	0.02	0.06	0.03	0.00	0.00	0.11
157.5->180.0	0.04	0.06	0.04	0.00	0.00	0.14
180.0->202.5	0.05	0.06	0.09	0.00	0.00	0.21
202.5->225.0	0.06	0.17	0.17	0.00	0.00	0.40
225.0->247.5	0.11	0.30	0.18	0.00	0.00	0.59
247.5->270.0	0.31	0.48	0.05	0.00	0.00	0.84
270.0->292.5	0.42	0.53	0.03	0.00	0.00	0.98
292.5->315.0	0.16	0.56	0.09	0.00	0.00	0.80
315.0->337.5	0.17	0.42	0.06	0.00	0.00	0.64
337.5->360.0	0.13	0.44	0.12	0.00	0.00	0.69
SubTotal	1.93	3.74	1.14	0.00	0.00	6.82

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in Pasquill Class F

Statistics Period - Start 1988 001JD 00:10 1988 January 01 00:10
End 1988 366JD 23:50 1988 December 31 23:50

52376 10min averages used for statistics.
52703 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	0.06	0.06	0.01	0.00	0.00	0.14
22.5-> 45.0	0.05	0.11	0.02	0.00	0.00	0.18
45.0-> 67.5	0.03	0.09	0.00	0.00	0.00	0.13
67.5-> 90.0	0.06	0.05	0.00	0.00	0.00	0.11
90.0->112.5	0.04	0.02	0.00	0.00	0.00	0.06
112.5->135.0	0.04	0.02	0.01	0.00	0.00	0.07
135.0->157.5	0.02	0.03	0.02	0.00	0.00	0.07
157.5->180.0	0.02	0.02	0.00	0.00	0.00	0.04
180.0->202.5	0.02	0.05	0.01	0.00	0.00	0.08
202.5->225.0	0.06	0.07	0.02	0.00	0.00	0.15
225.0->247.5	0.07	0.13	0.03	0.00	0.00	0.24
247.5->270.0	0.20	0.11	0.00	0.00	0.00	0.32
270.0->292.5	0.25	0.10	0.00	0.00	0.00	0.35
292.5->315.0	0.09	0.11	0.00	0.00	0.00	0.20
315.0->337.5	0.06	0.13	0.00	0.00	0.00	0.20
337.5->360.0	0.08	0.19	0.02	0.00	0.00	0.29
SubTotal	1.14	1.32	0.15	0.00	0.00	2.61

Table 25 Joint frequency distribution for Cherrywood, 1988, in all stability classes.

Wind Speed (m/s) v. Direction (deg.true) :
Frequency of occurrence (%) in all Pasquill classes

Statistics Period - Start 1988 001JD 00:10 1988 January 01 00:10
End 1988 366JD 23:50 1988 December 31 23:50

52376 10min averages used for statistics.
52703 total 10min periods between Start and End

Speed	0->2	2->3	3->5	5->6	6->	SubTotal
Direction						
0.0-> 22.5	3.45	0.92	0.74	0.10	0.03	5.25
22.5-> 45.0	2.00	0.91	0.65	0.09	0.09	3.74
45.0-> 67.5	1.50	0.77	0.53	0.07	0.04	2.90
67.5-> 90.0	1.31	0.95	1.37	0.41	0.53	4.58
90.0->112.5	1.34	1.24	1.62	0.46	0.44	5.10
112.5->135.0	1.11	1.00	1.62	0.20	0.10	4.03
135.0->157.5	0.99	1.17	2.00	0.11	0.02	4.30
157.5->180.0	0.92	0.92	1.95	0.14	0.03	3.96
180.0->202.5	0.82	0.72	1.84	0.58	0.27	4.23
202.5->225.0	1.03	0.85	1.92	0.79	1.37	5.97
225.0->247.5	1.33	1.44	2.84	1.01	1.42	8.03
247.5->270.0	2.08	2.26	3.68	1.03	1.38	10.43
270.0->292.5	2.28	2.24	2.21	0.58	0.49	7.79
292.5->315.0	1.58	1.77	3.55	1.60	1.28	9.78
315.0->337.5	1.80	2.01	3.75	1.34	1.41	10.32
337.5->360.0	3.38	2.47	2.57	0.50	0.66	9.58
SubTotal	26.92	21.64	32.84	9.03	9.57	100.00

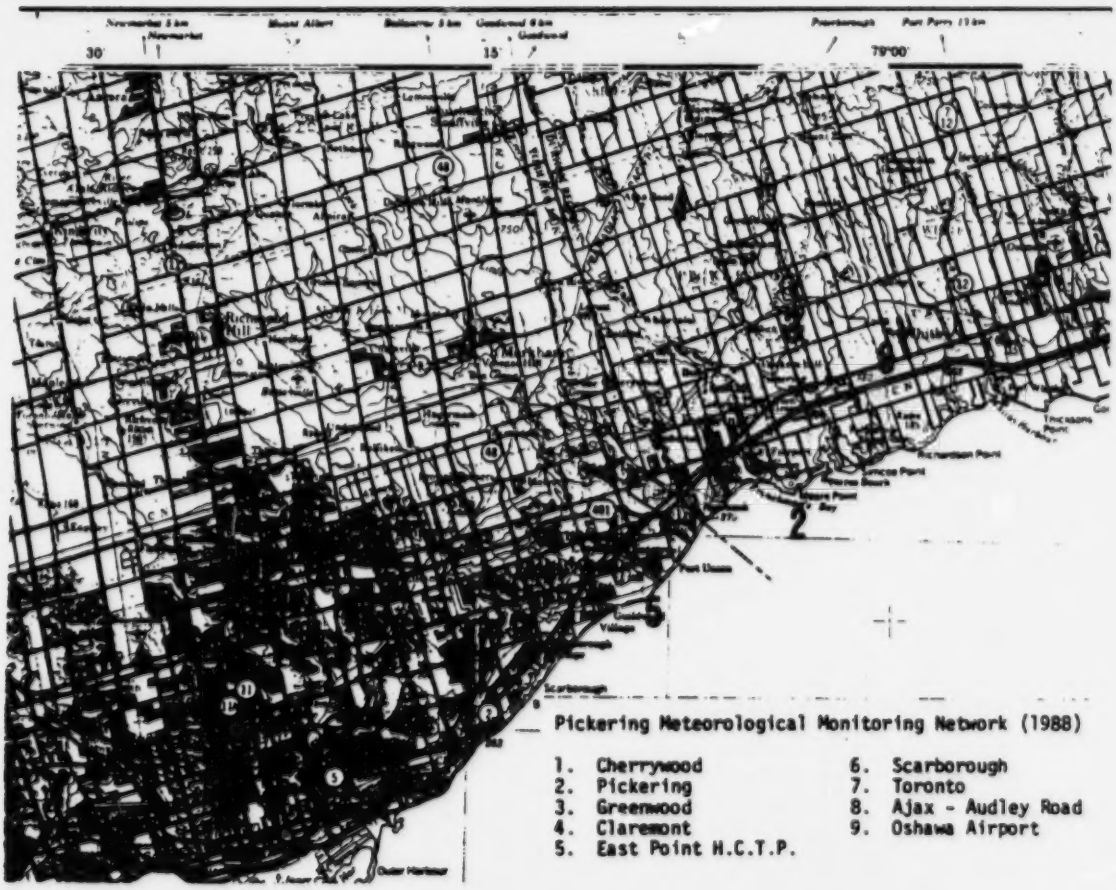


Figure 1. Location Map for the MesoNet stations.

Figure 2a. The PAQMOS 10m station at Cherrywood, looking to the east.

Figure 2b. A general view of the 26m tower at Cherrywood, looking to the north.

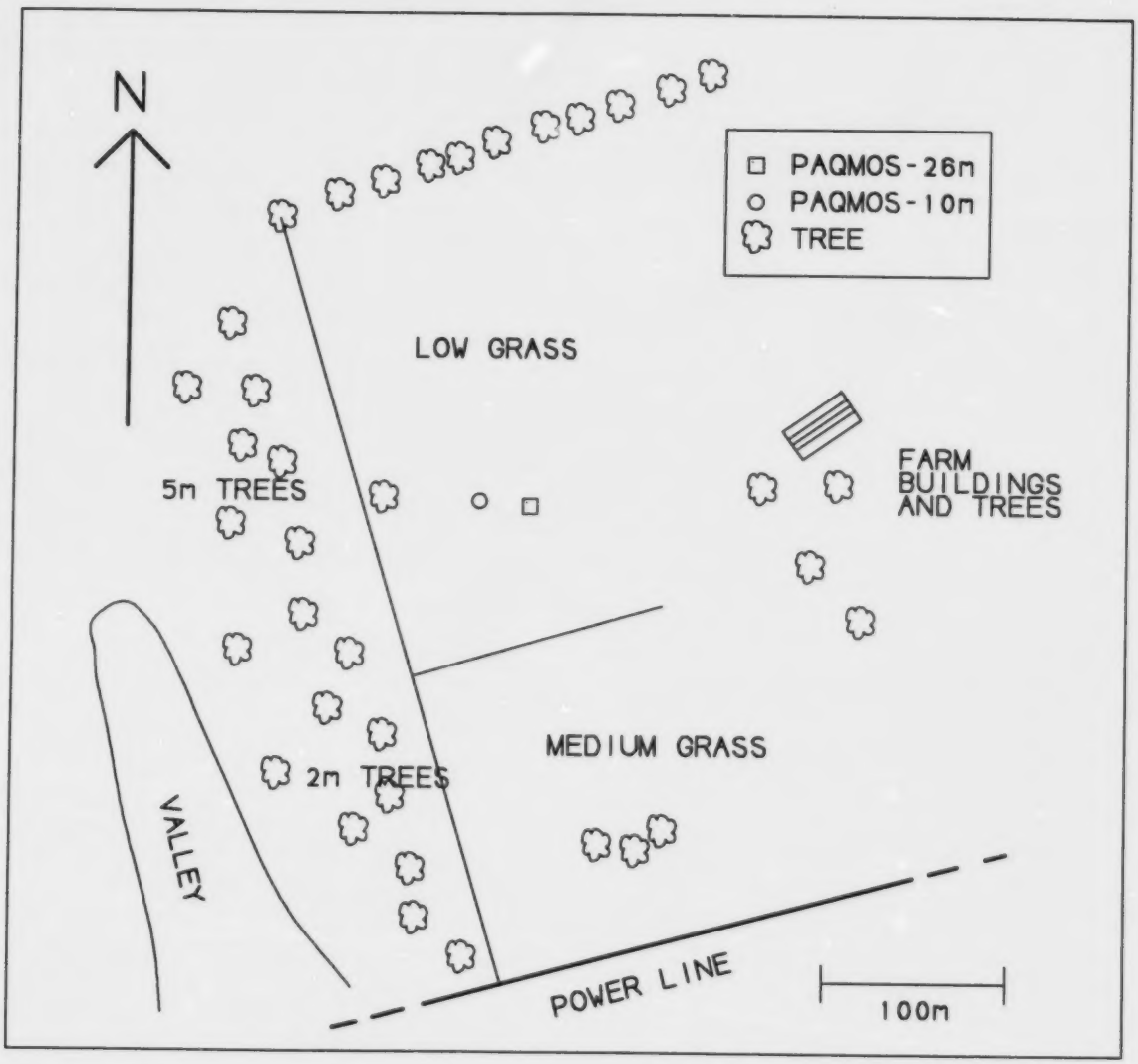


Figure 2c. A sketch of the layout of the Cherrywood primary site.

Figure 3a. The PAQMOS 10m station at the Pickering NGS site looking to the east.

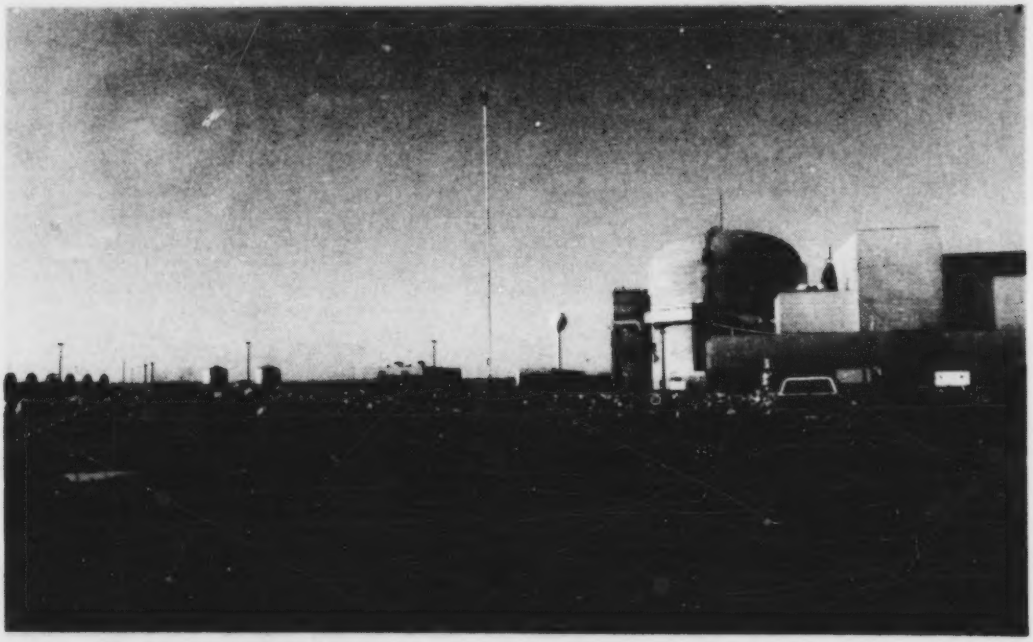


Figure 3b. The PAQMOS 10m station at the Pickering NGS site looking to the west.

Figure 4. The PAQMOS 10m station at the Greenwood site looking to the north.

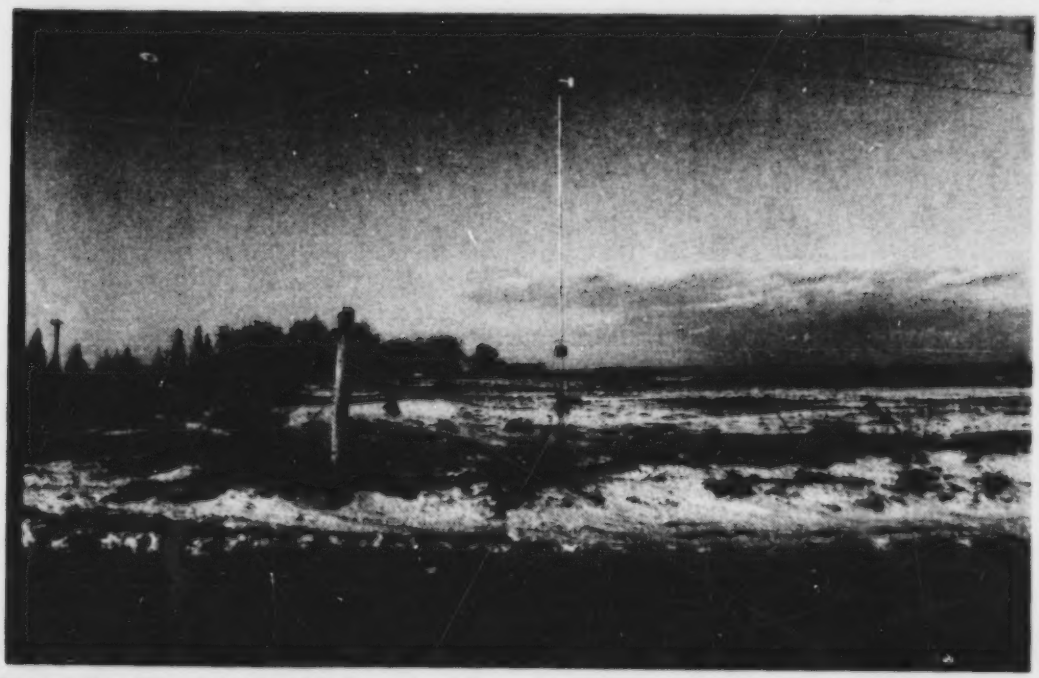


Figure 5. The PAQMOS 10m station at the Claremont site looking to the north.

Figure 6. The PAQMOS 10m station at the East Point site looking to the east and showing the Pickering NGS in the background.

Figure 8. The PAQMOS 10m station at the Toronto site looking to the north.

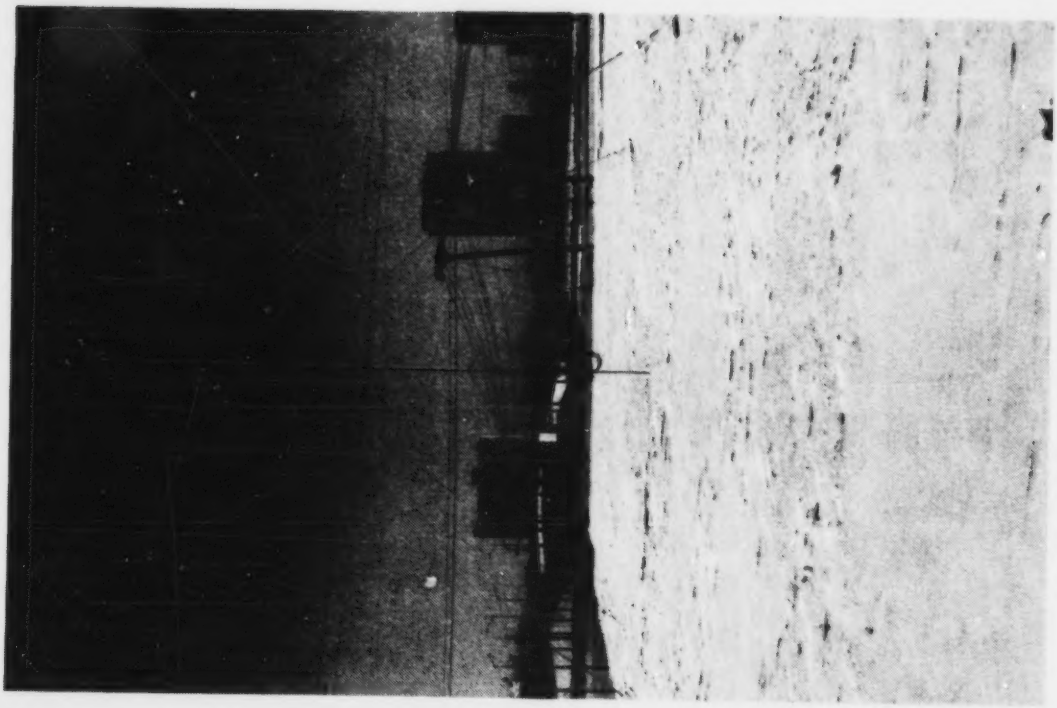


Figure 7a. The PAQMOS 10m station at the Scarborough site looking to the east.

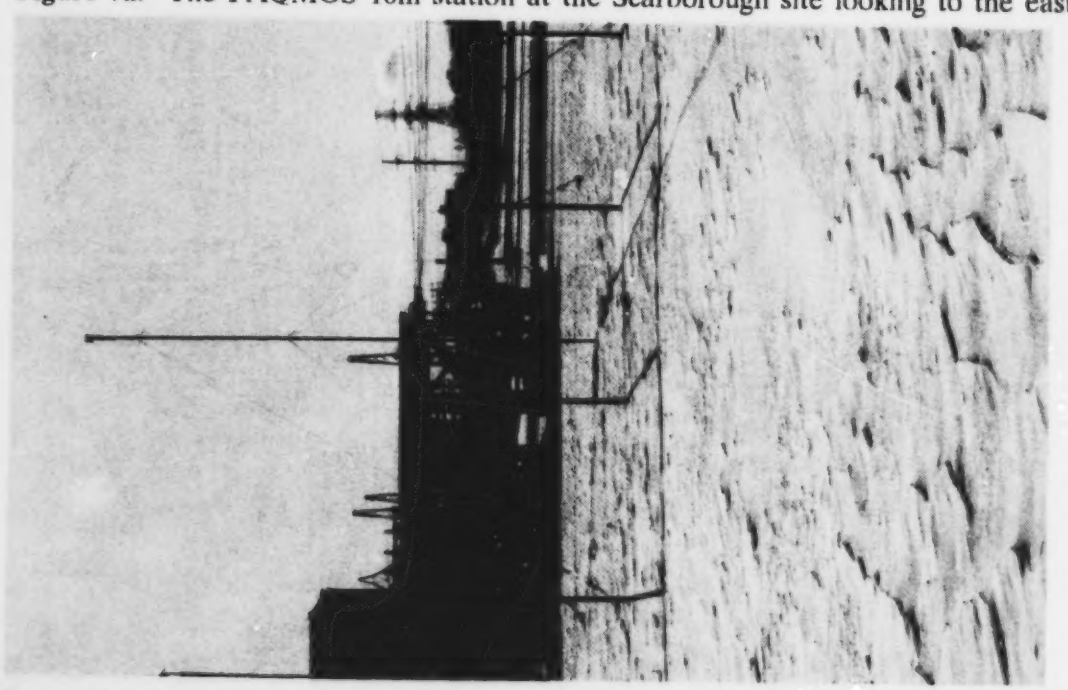


Figure 7b. The PAQMOS 10m station at the Scarborough site looking to the south.

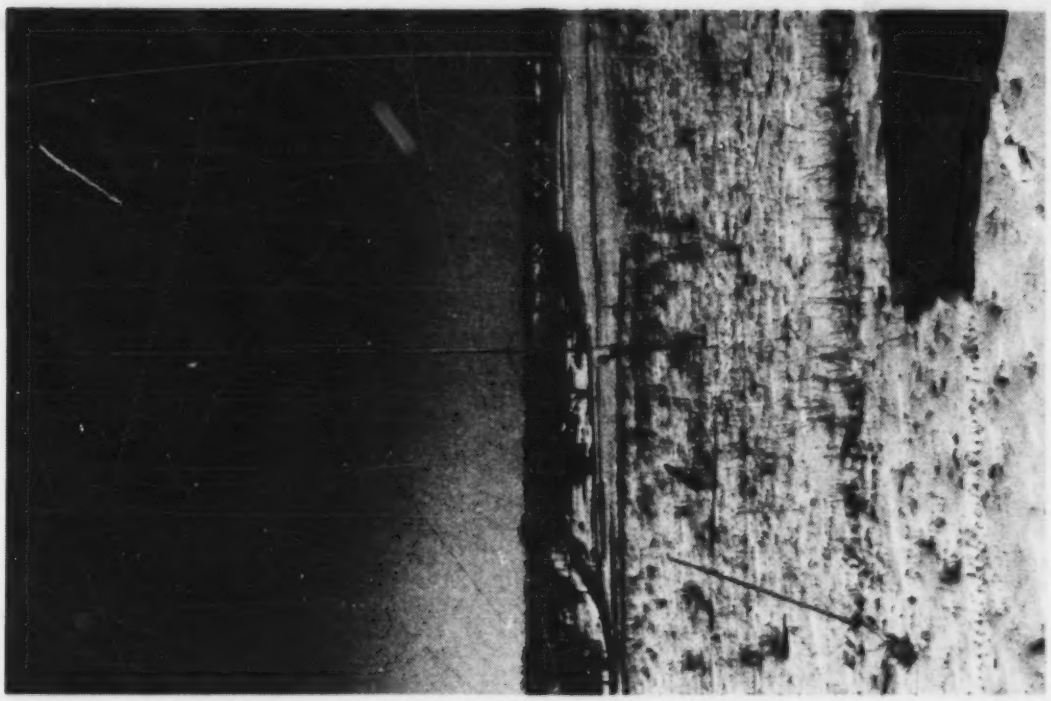


Figure 9. The PAQMOS 10m station at the Ajax site looking to the east.

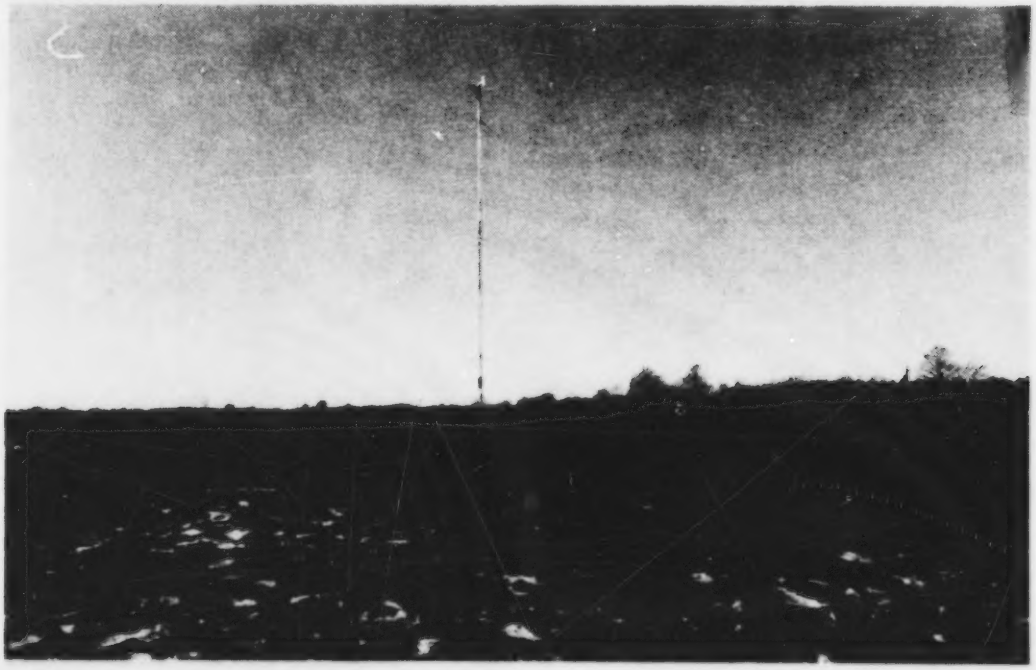


Figure 10. The PAQMOS 10m station at the Oshawa site looking to the west.

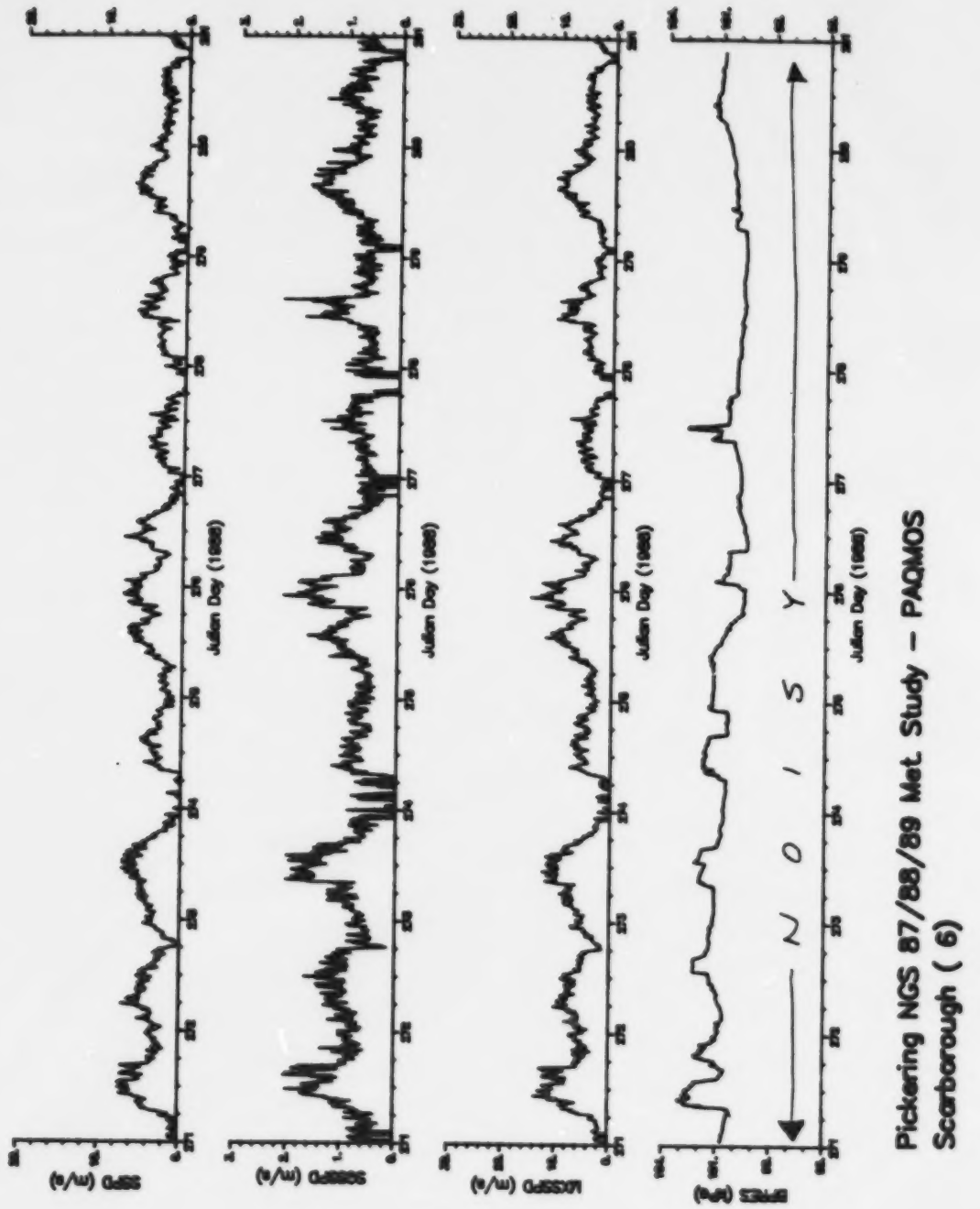


Figure 11. Sample plots of initial data for PN6 using TNTPL for the period JD271-281. Following inspection of these plots the pressure data were judged to be in error and were deleted from the data archive.

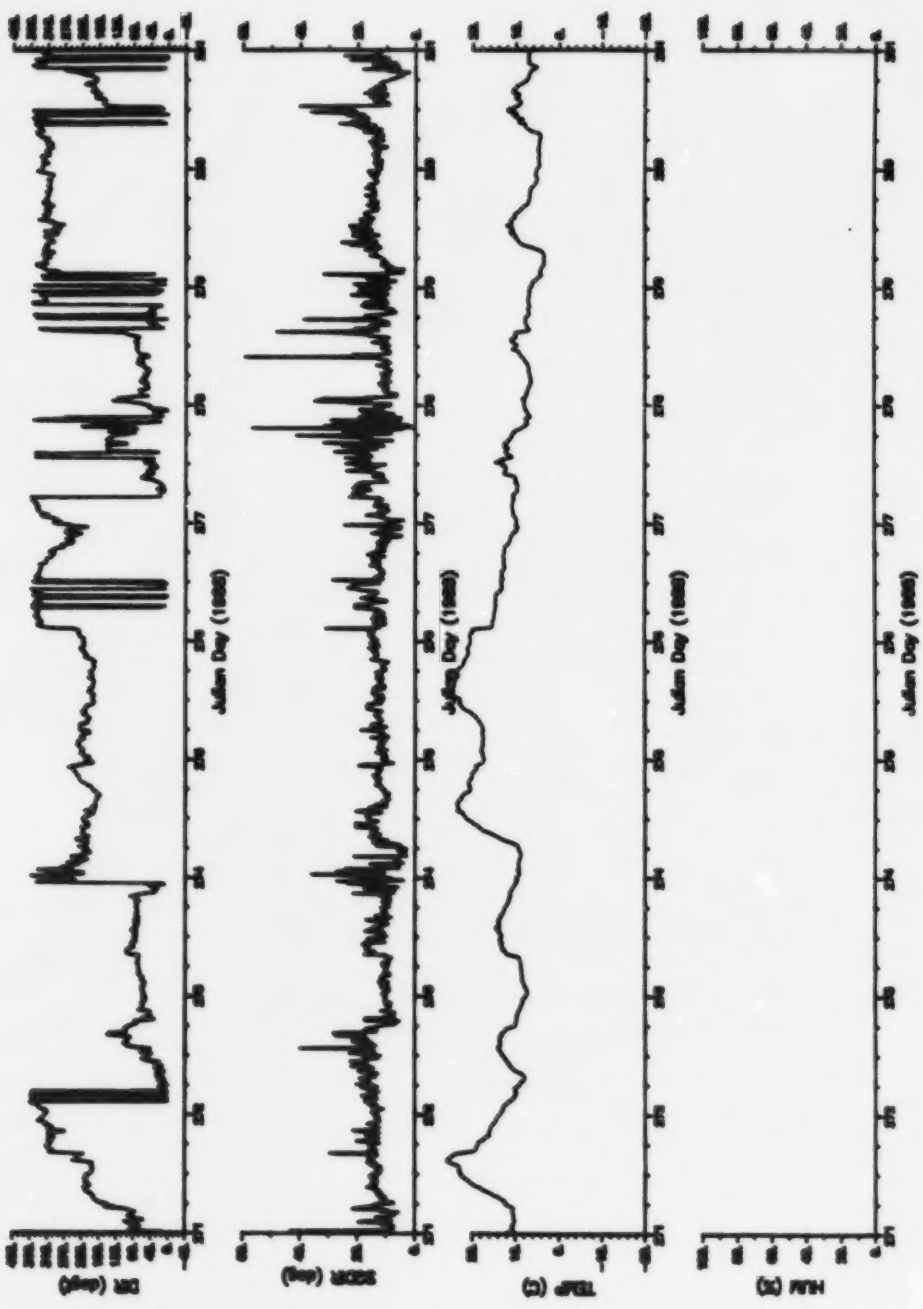


Figure 11. Continued.

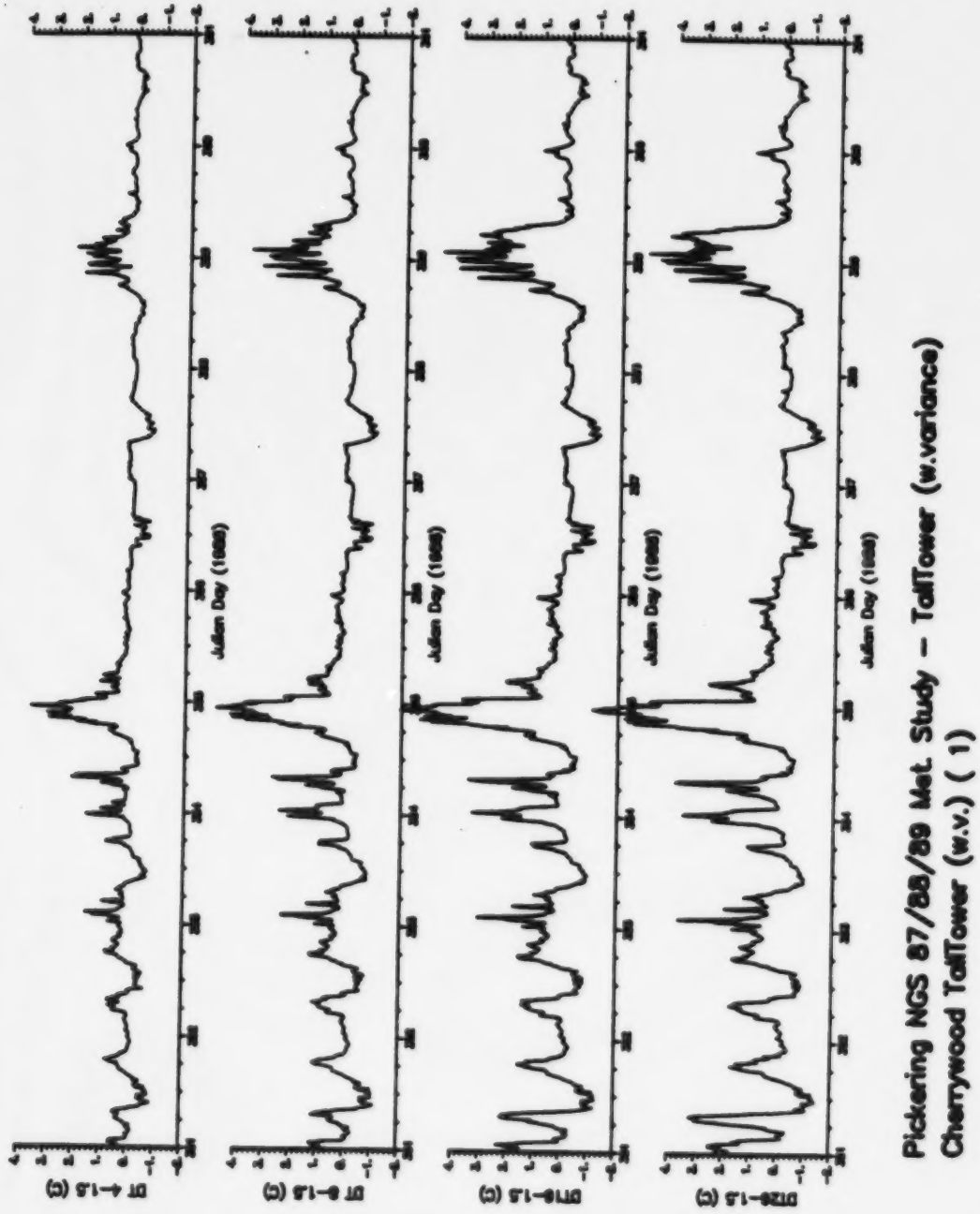


Figure 12. Sample plots of data from the 26m tower using TNTPL for the period JD351-361. Note the strong temperature inversions developing in light wind situations, especially on the night of JD354,355.

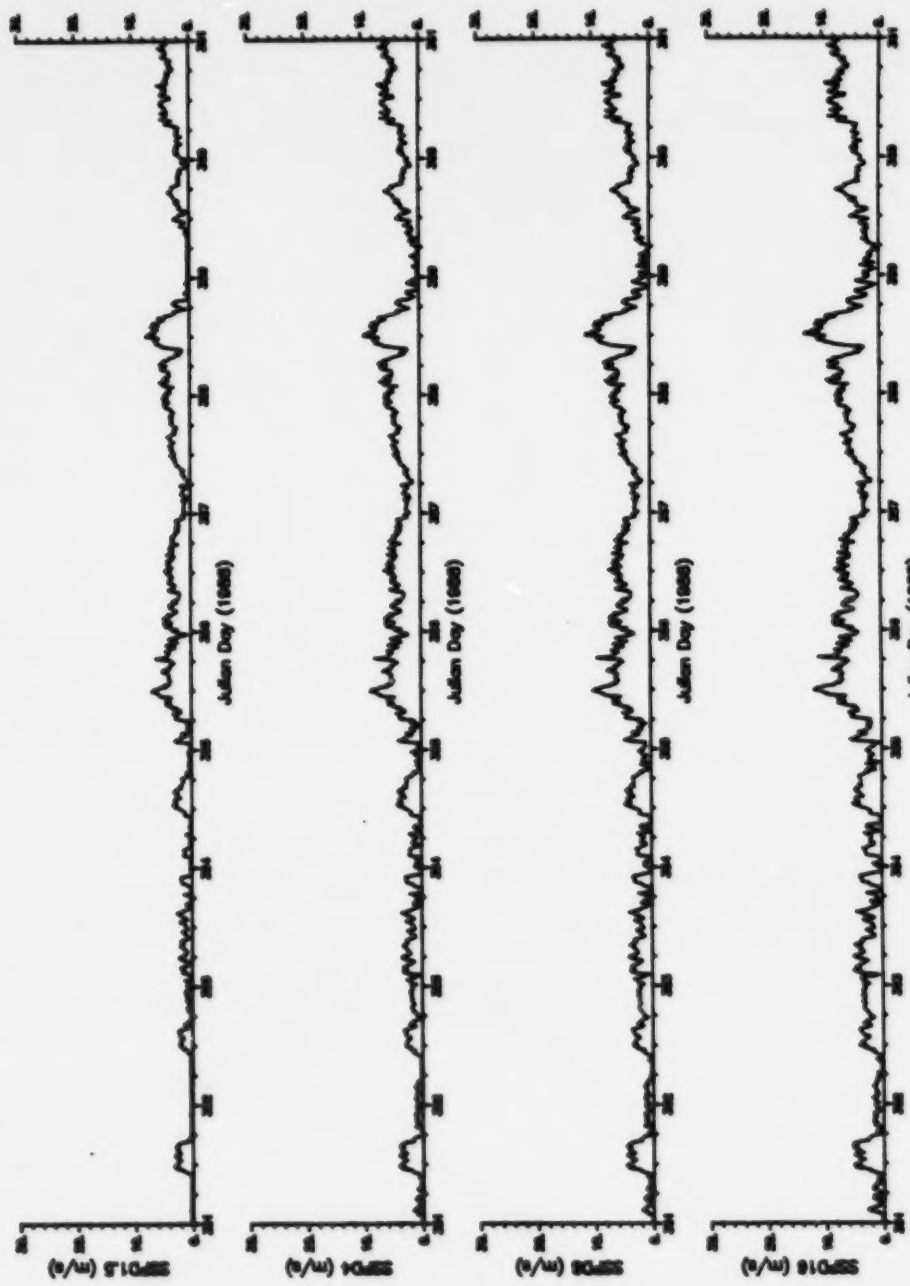


Figure 12. Continued.

Figure 12. Continued.

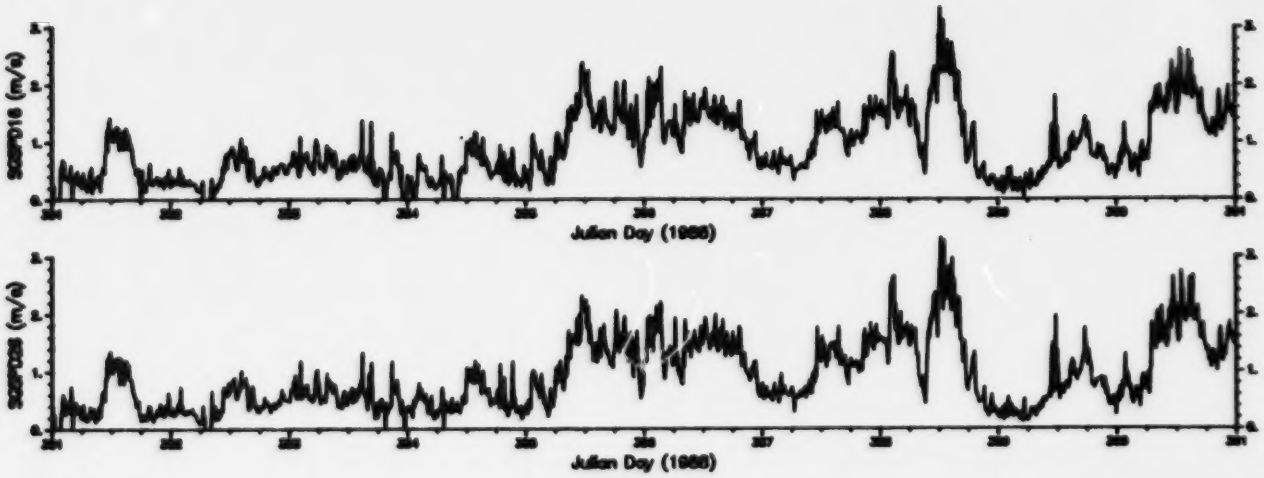


Figure 12. Continued.

Pickering NGS 87/88/89 Met. Study – TallTower (w.variance)
Cherrywood TallTower (w.v.) (1)

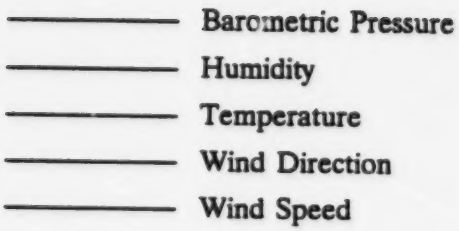
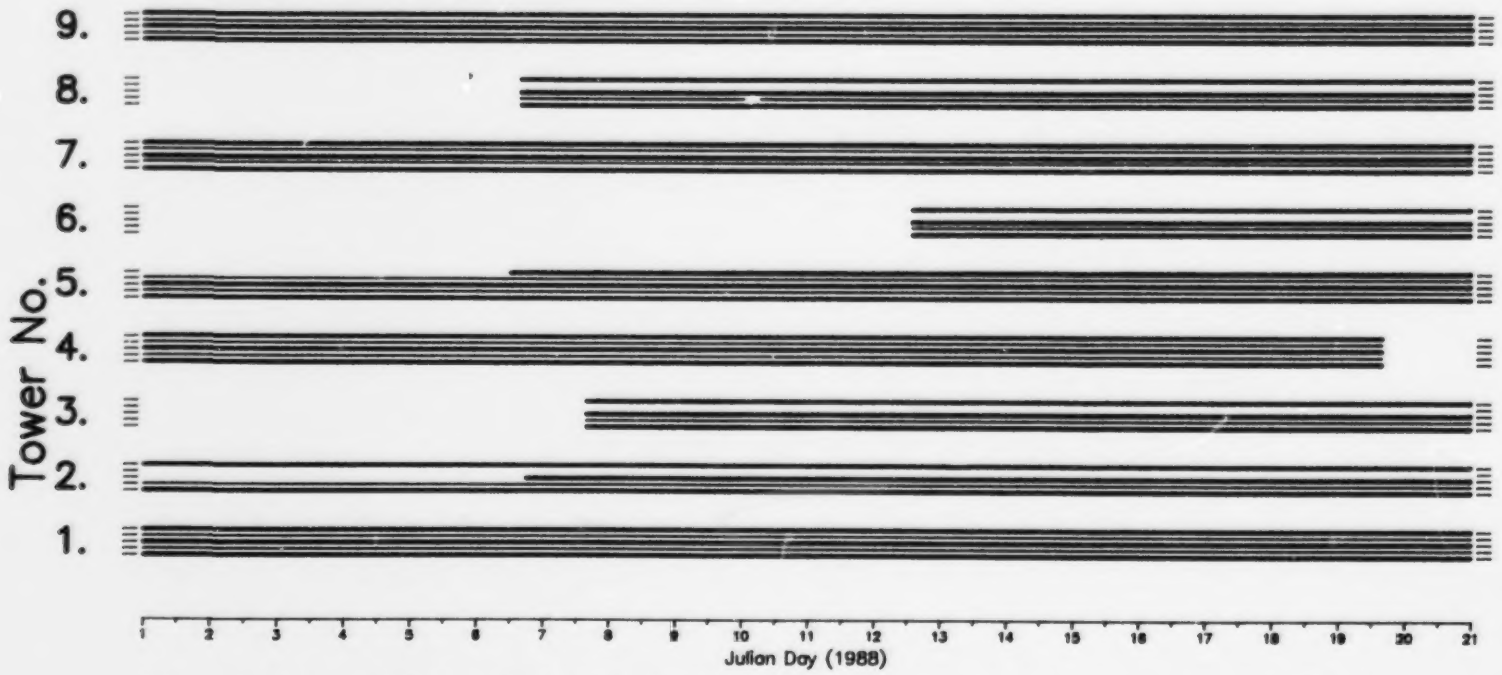
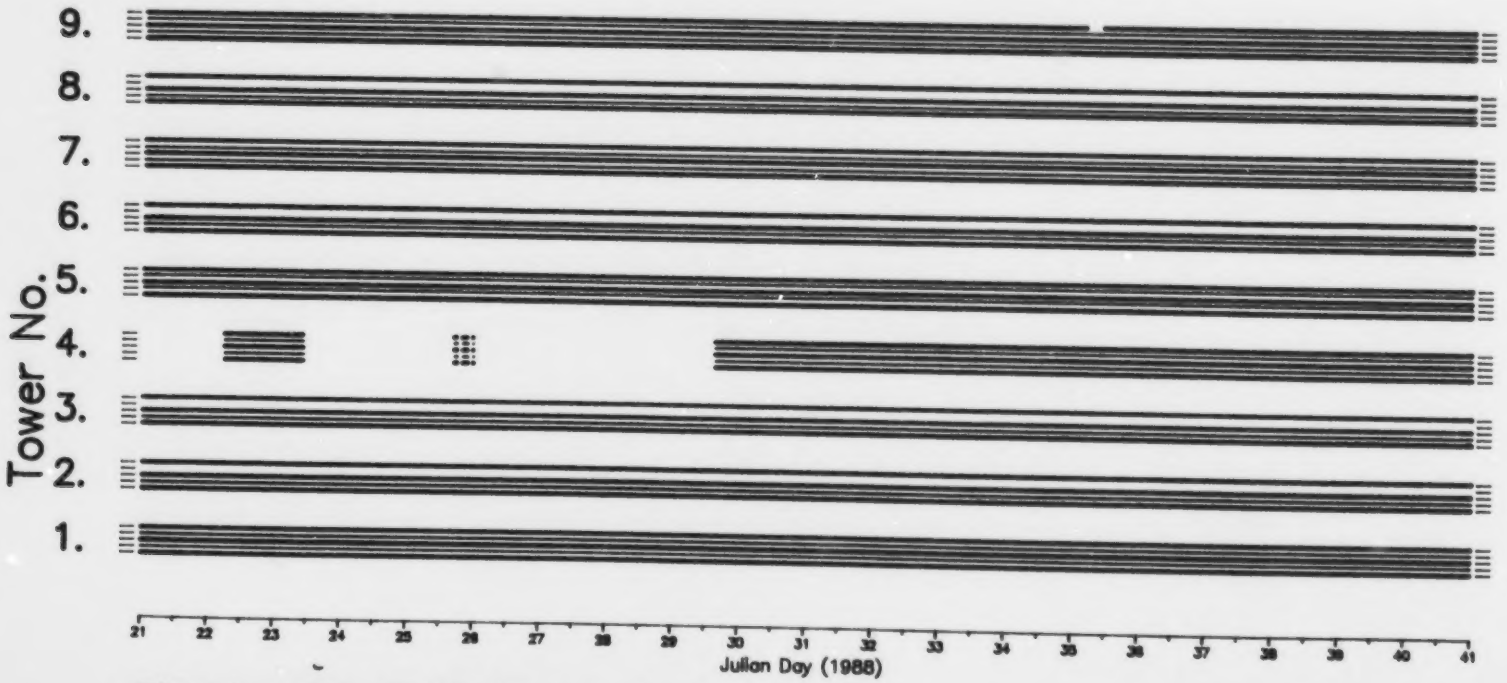


Figure 13. Graphical representation of the data availability in the PAQMOS-10m data archive. The legend above shows the correspondence between horizontal lines and measured parameters. The graphs follow.



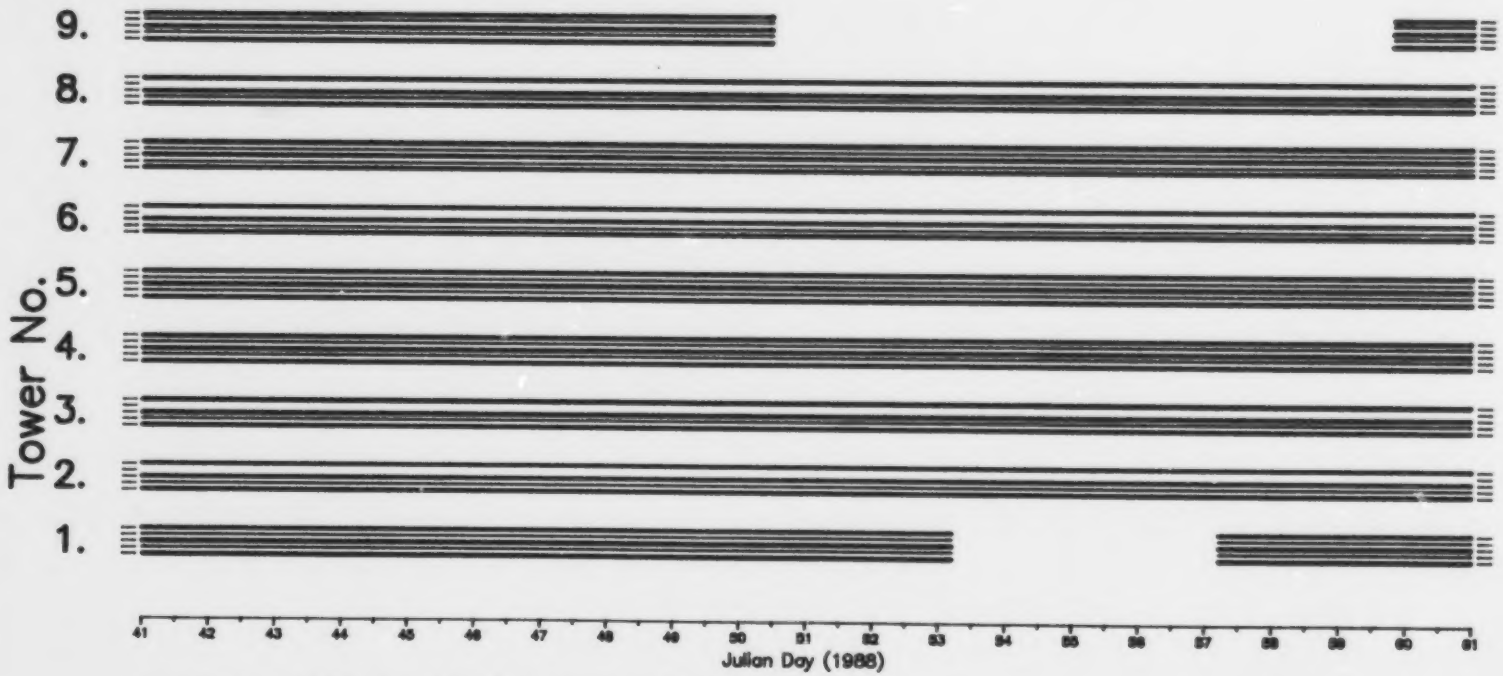
Pickering NGS 87/88/89 Met. Study – PAQMOS

Data availability



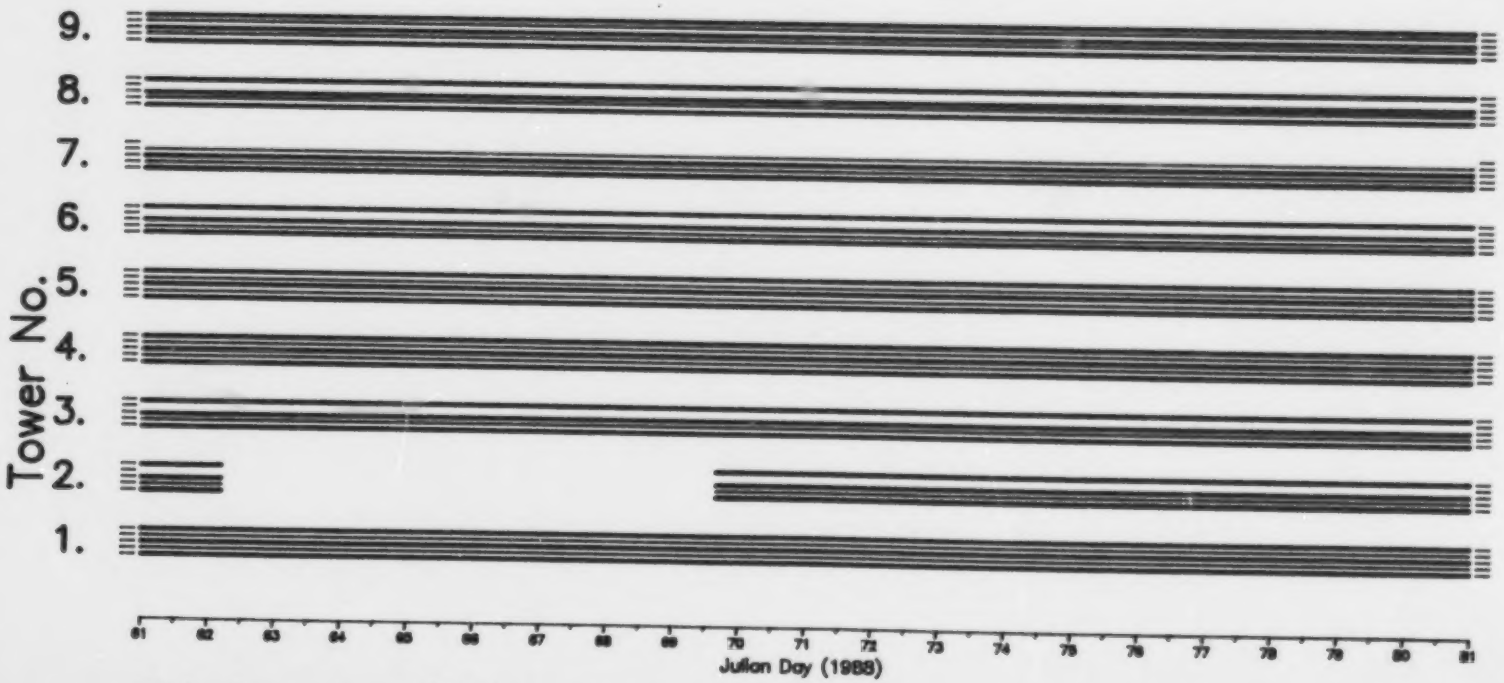
Pickering NGS 87/88/89 Met. Study – PAQMOS

Data availability



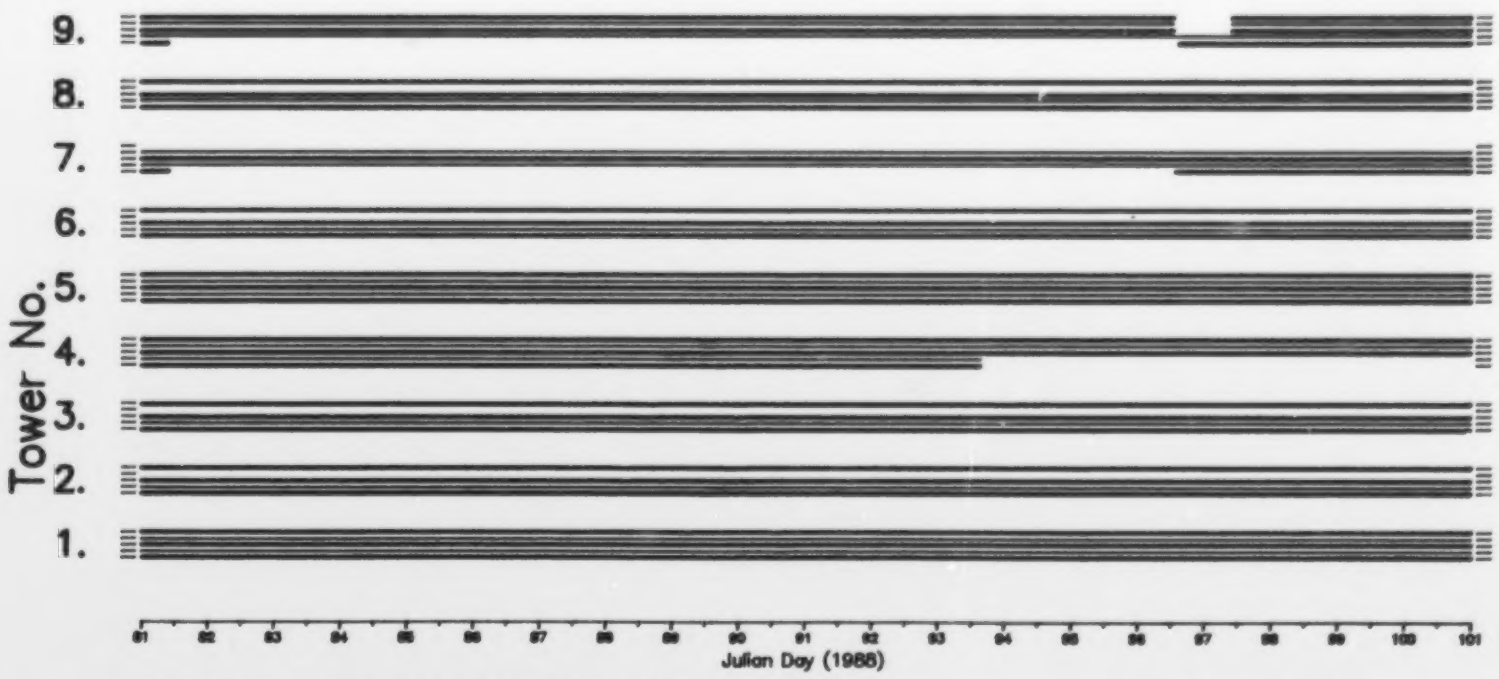
Pickering NGS 87/88/89 Met. Study – PAQMOS

Data availability



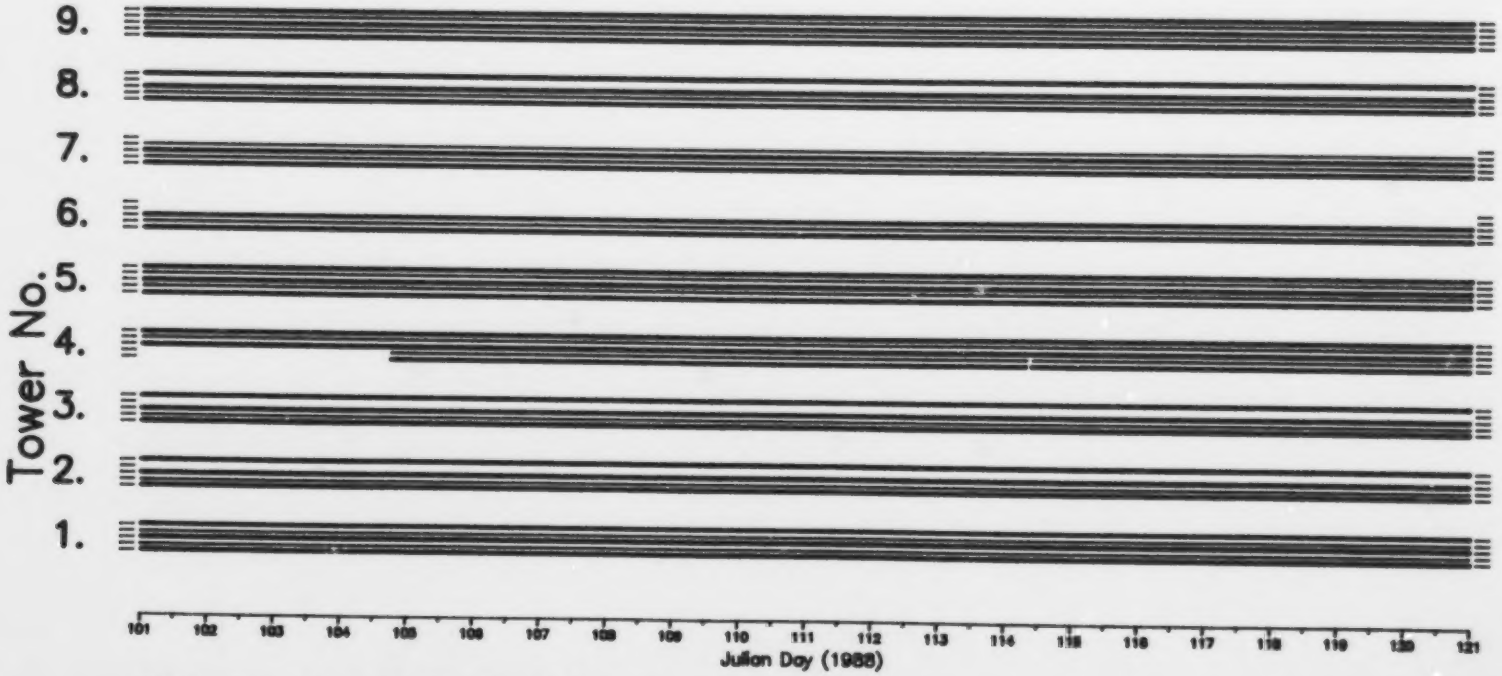
Pickering NGS 87/88/89 Met. Study – PAQMOS

Data availability



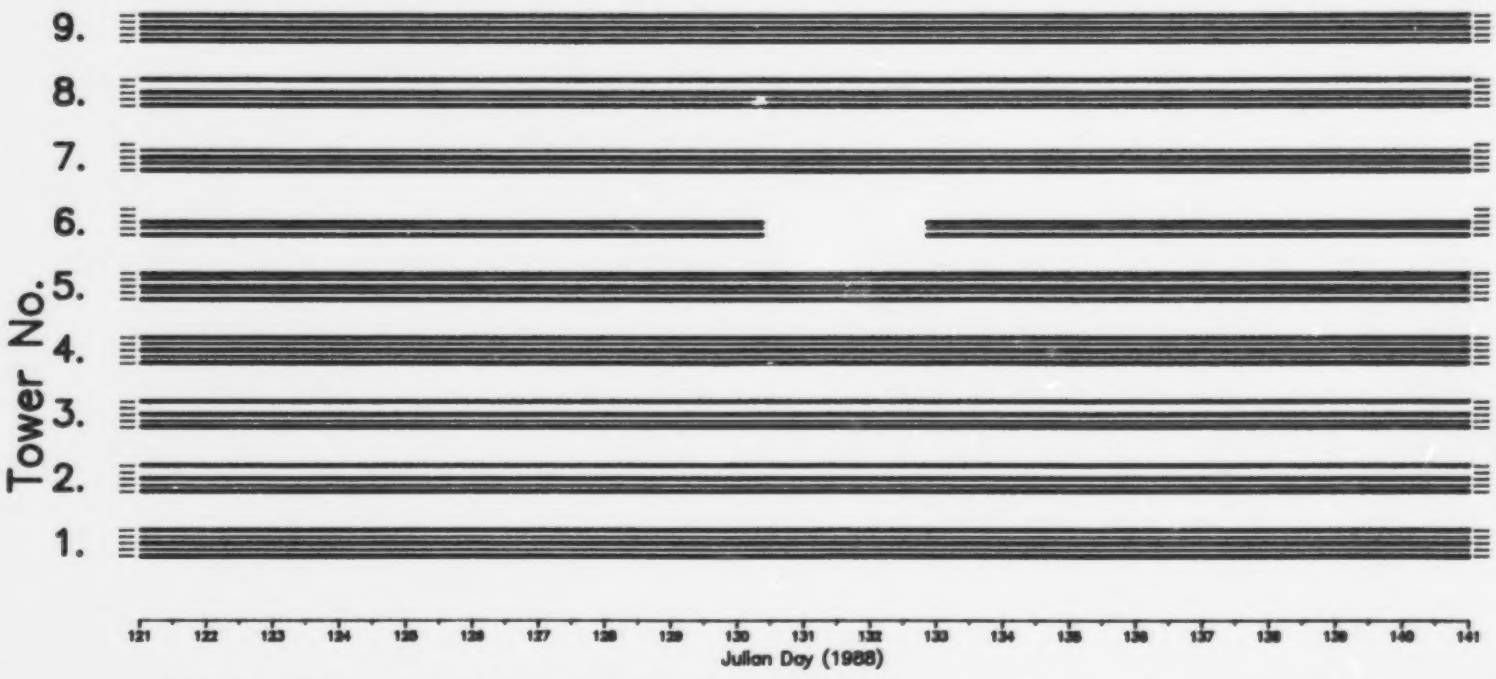
Pickering NGS 87/88/89 Met. Study – PAQMOS

Data availability



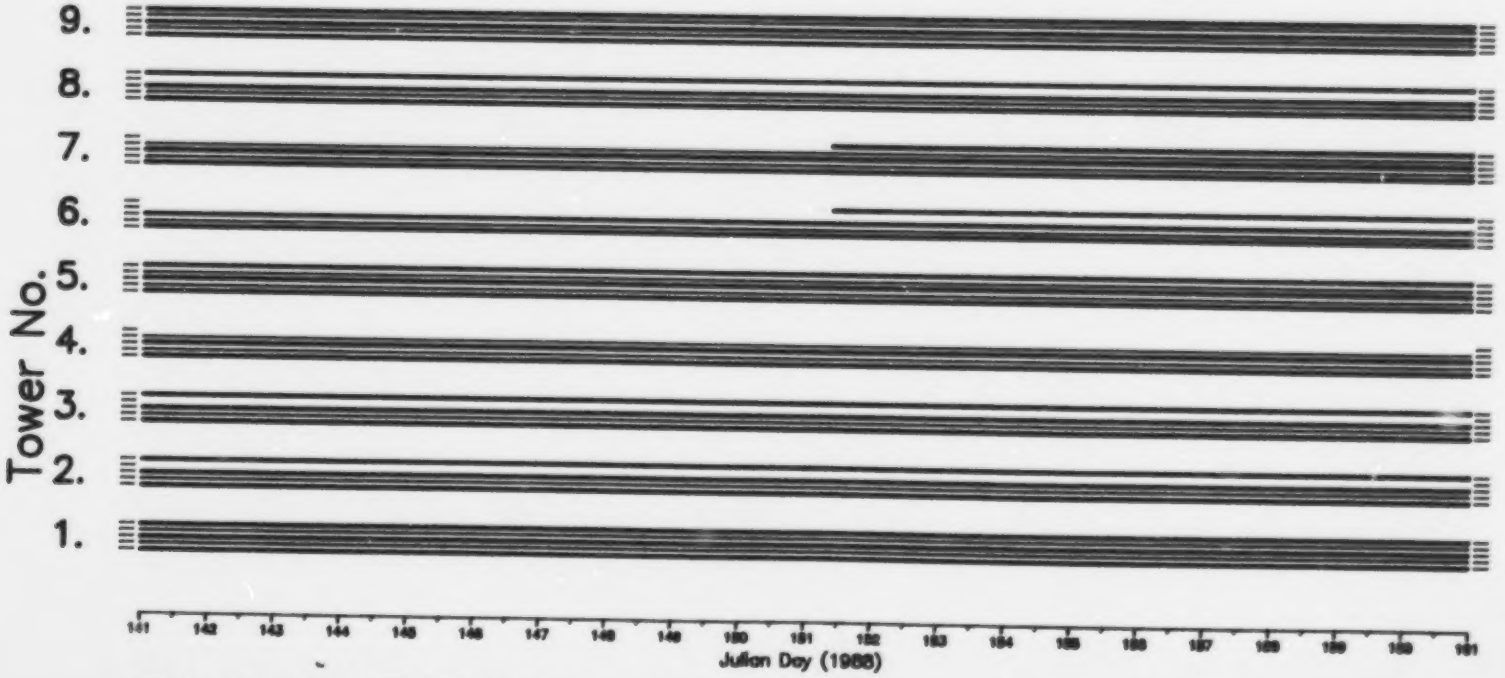
Pickering NGS 87/88/89 Met. Study – PAQMOS

Data availability



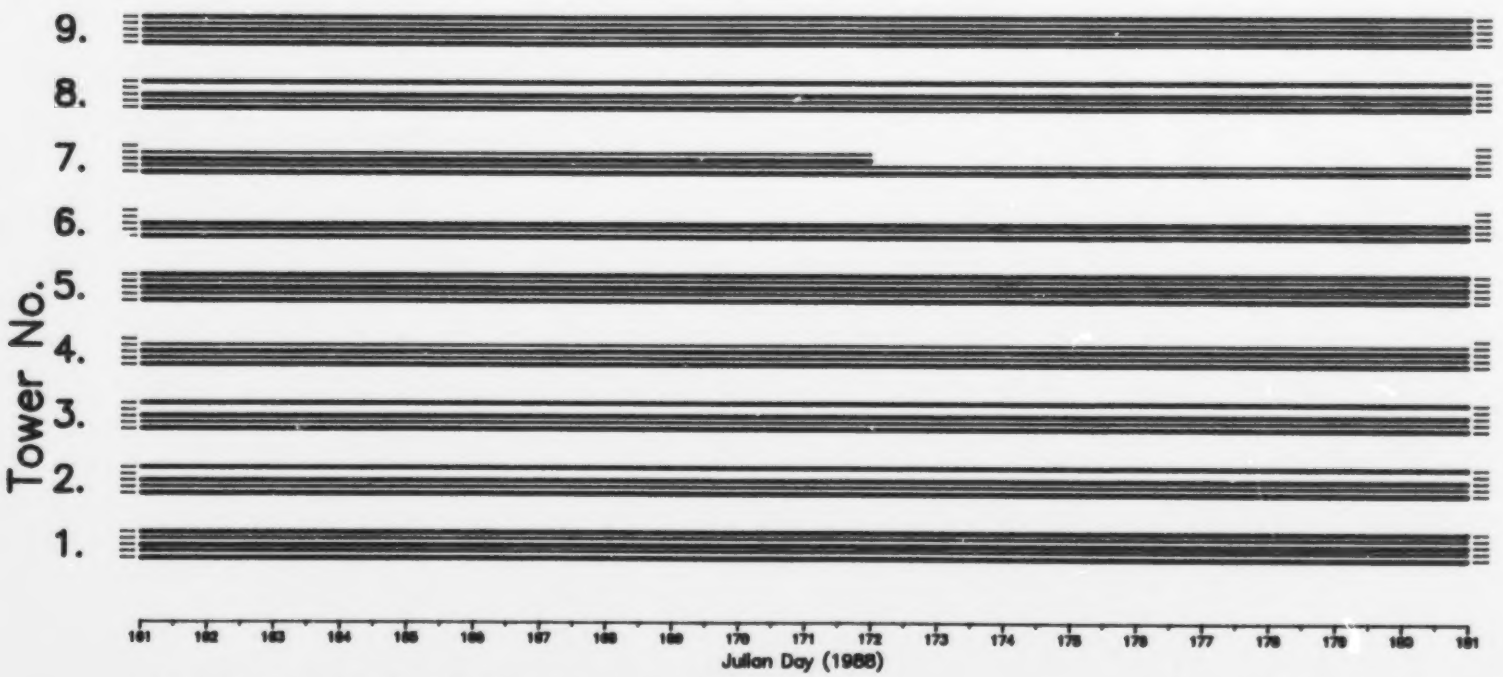
Pickering NGS 87/88/89 Met. Study – PAQMOS

Data availability



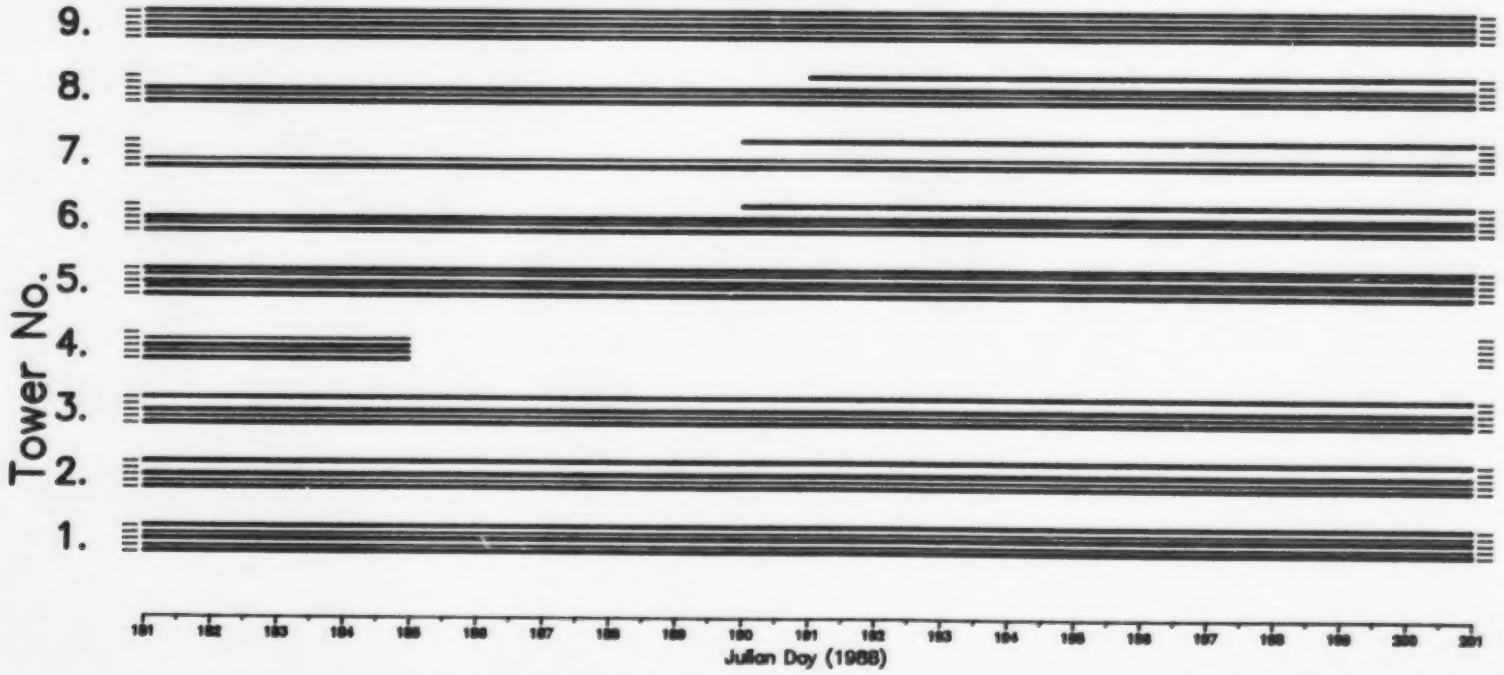
Pickering NGS 87/88/89 Met. Study – PAQMOS

Data availability



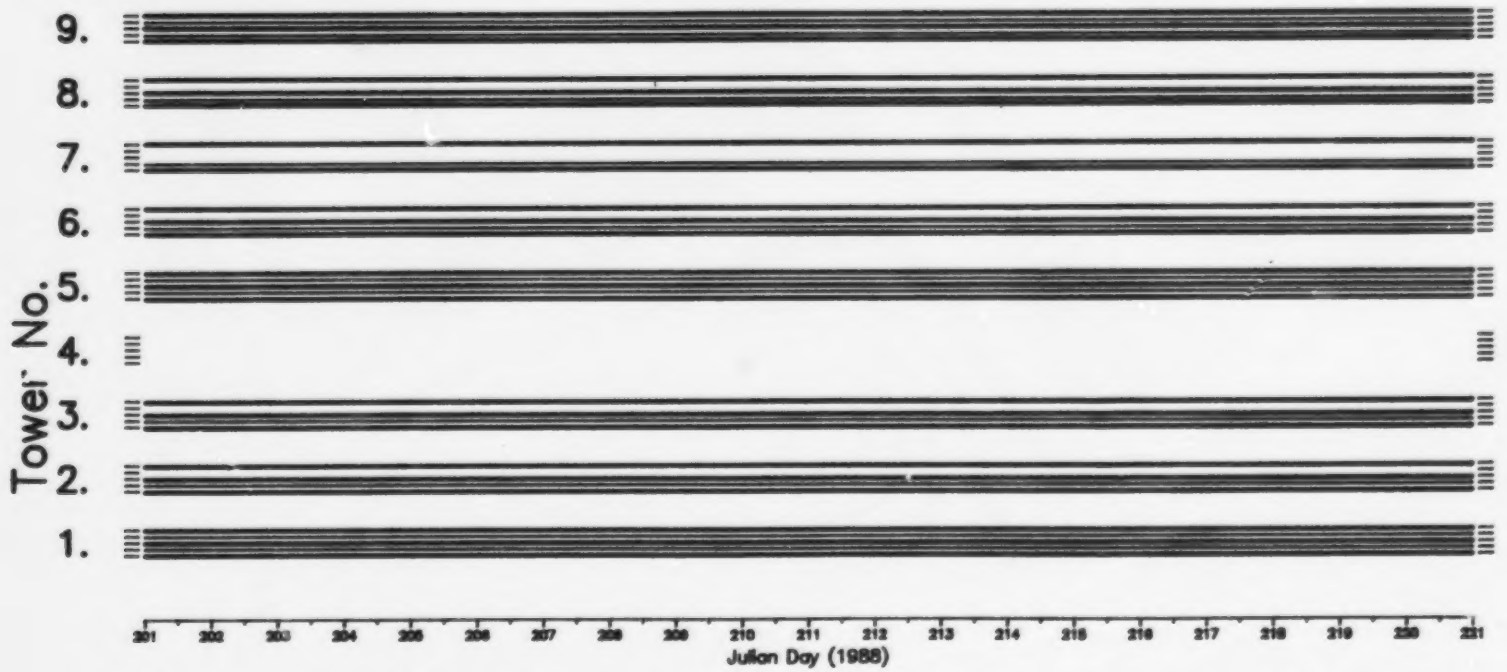
Pickering NGS 87/88/89 Met. Study – PAQMOS

Data availability



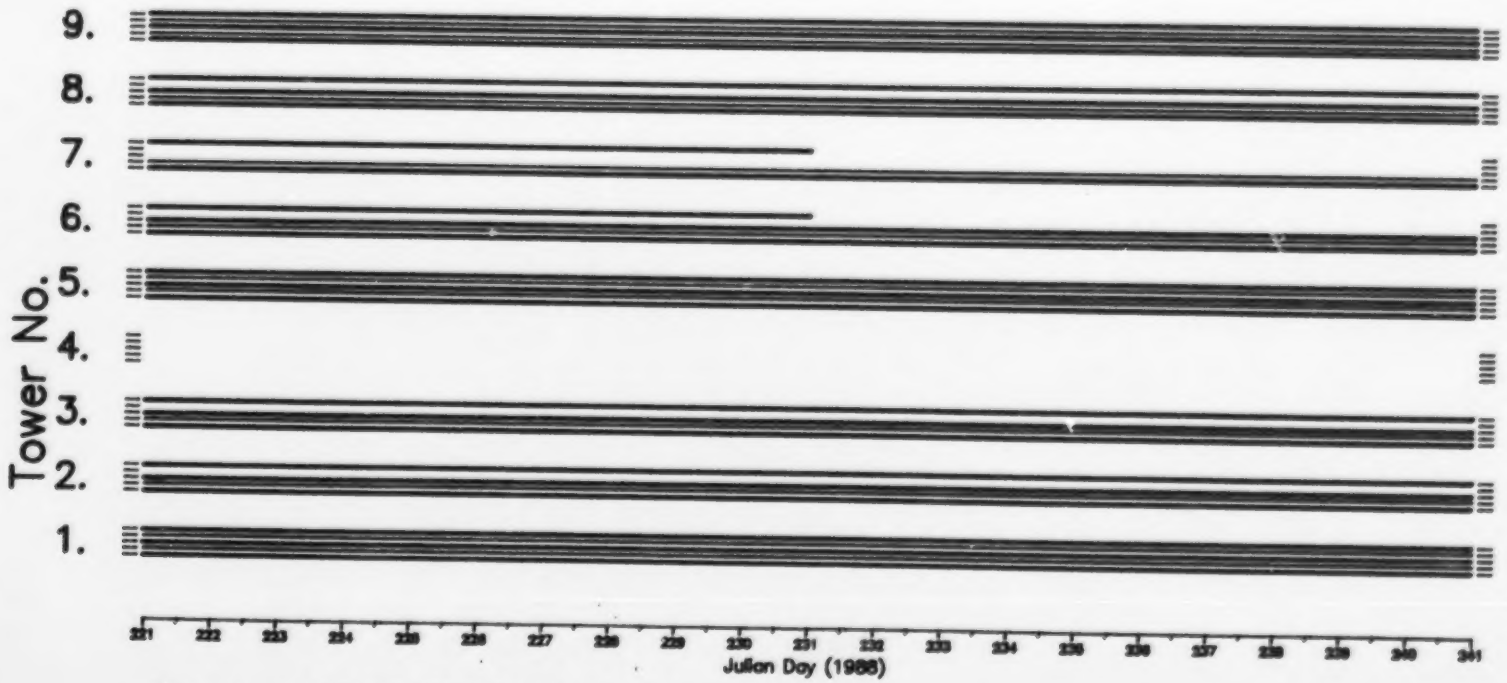
Pickering NGS 87/88/89 Met. Study – PAQMOS

Data availability



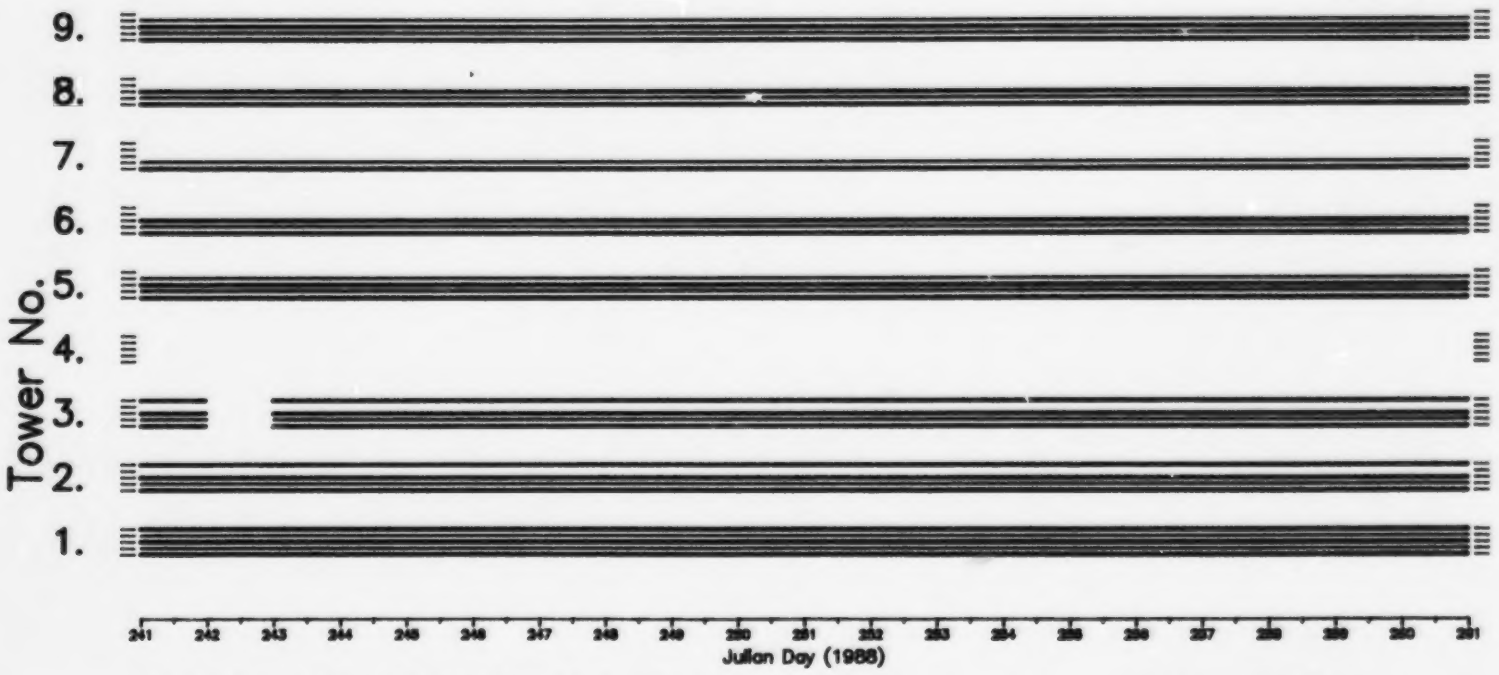
Pickering NGS 87/88/89 Met. Study – PAQMOS

Data availability



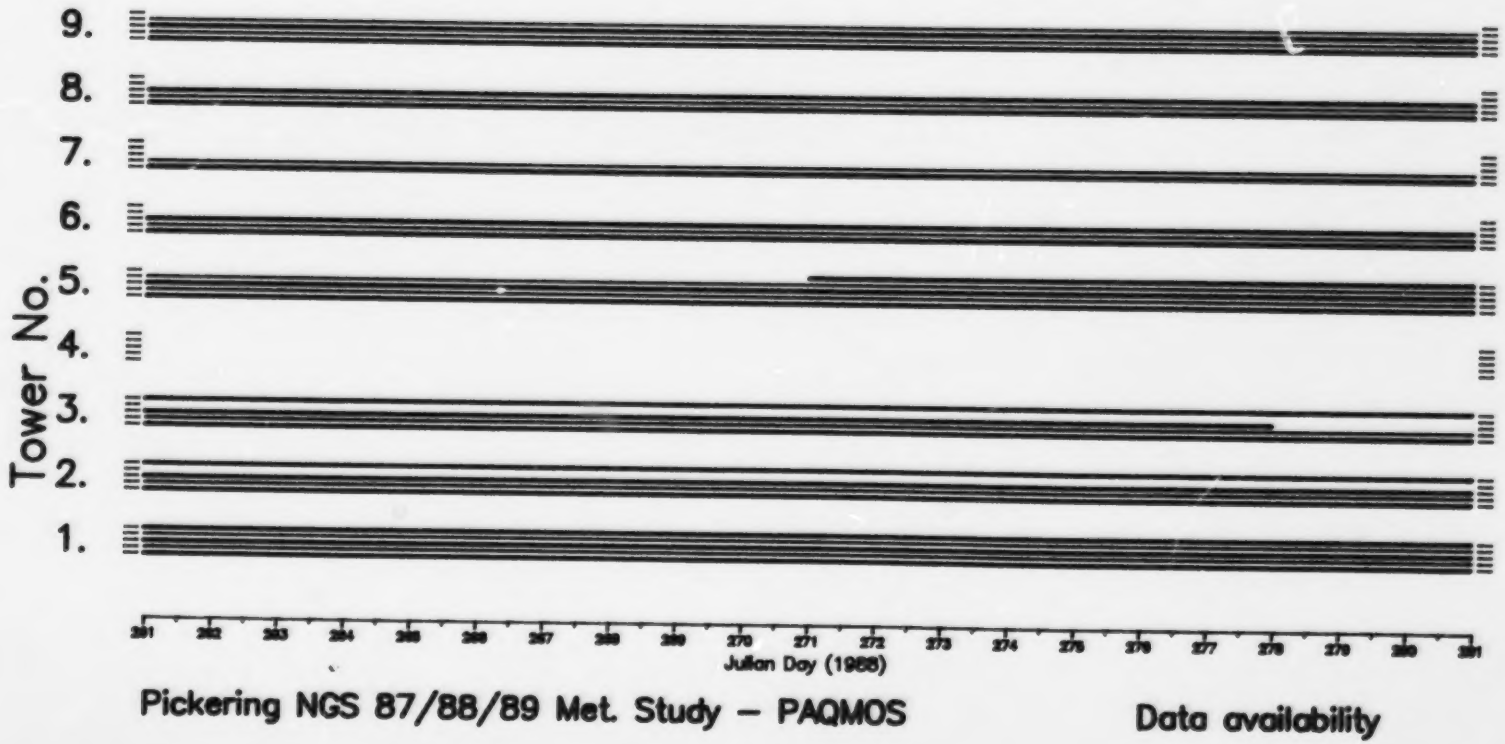
Pickering NGS 87/88/89 Met. Study – PAQMOS

Data availability



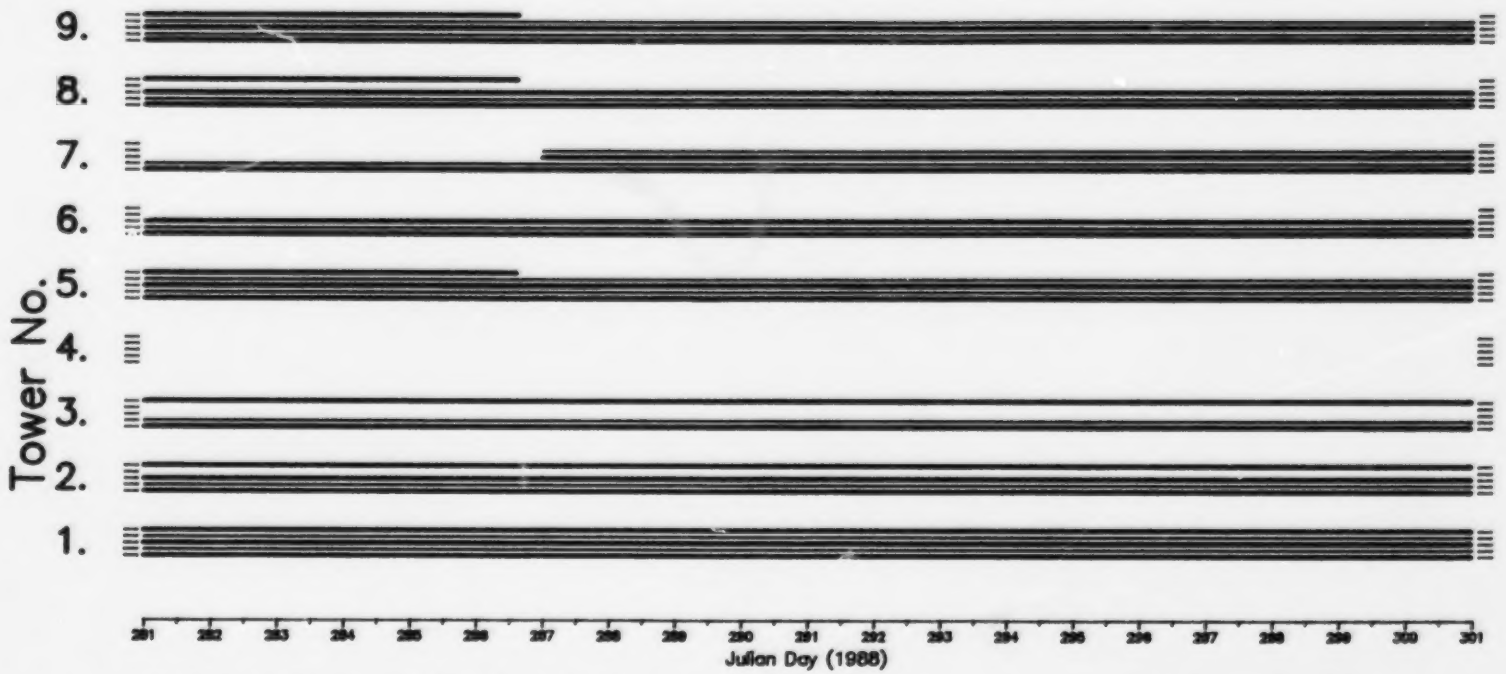
Pickering NGS 87/88/89 Met. Study – PAQMOS

Data availability



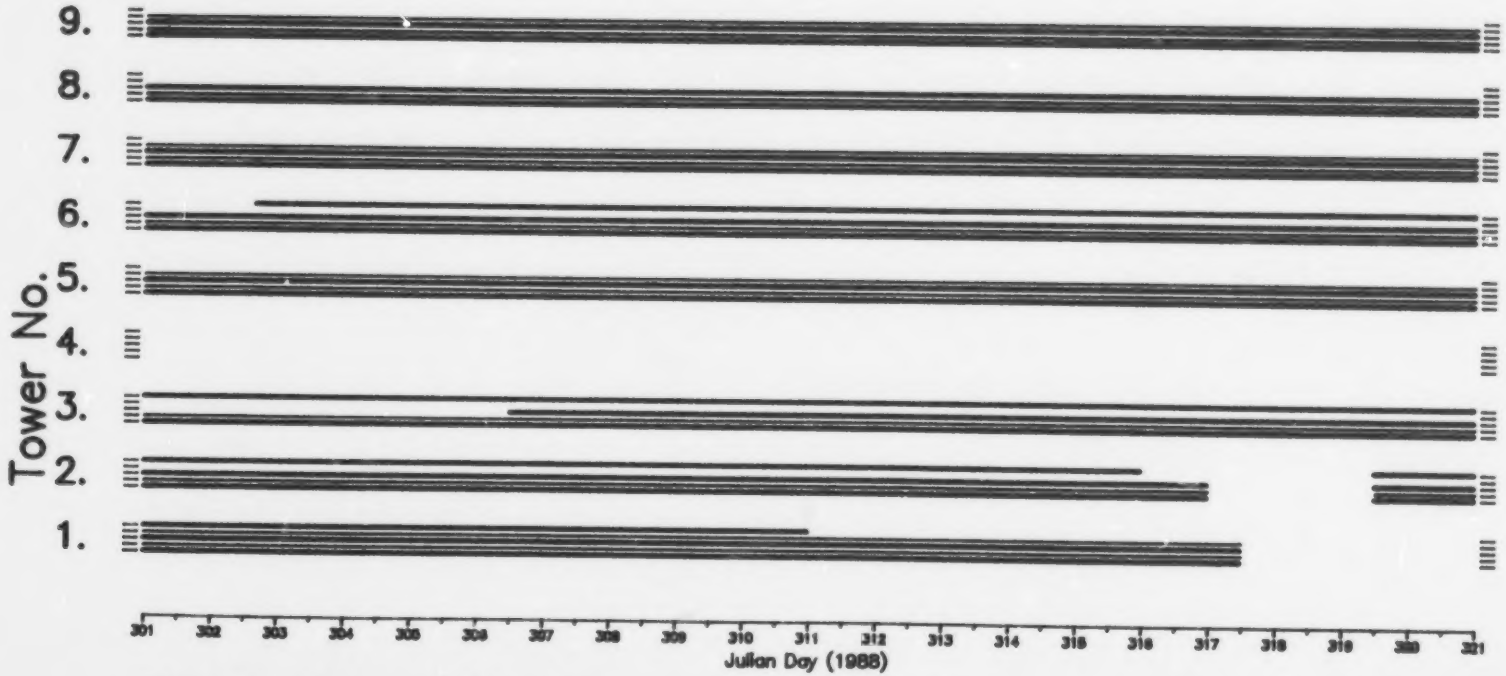
Pickering NGS 87/88/89 Met. Study – PAQMOS

Data availability



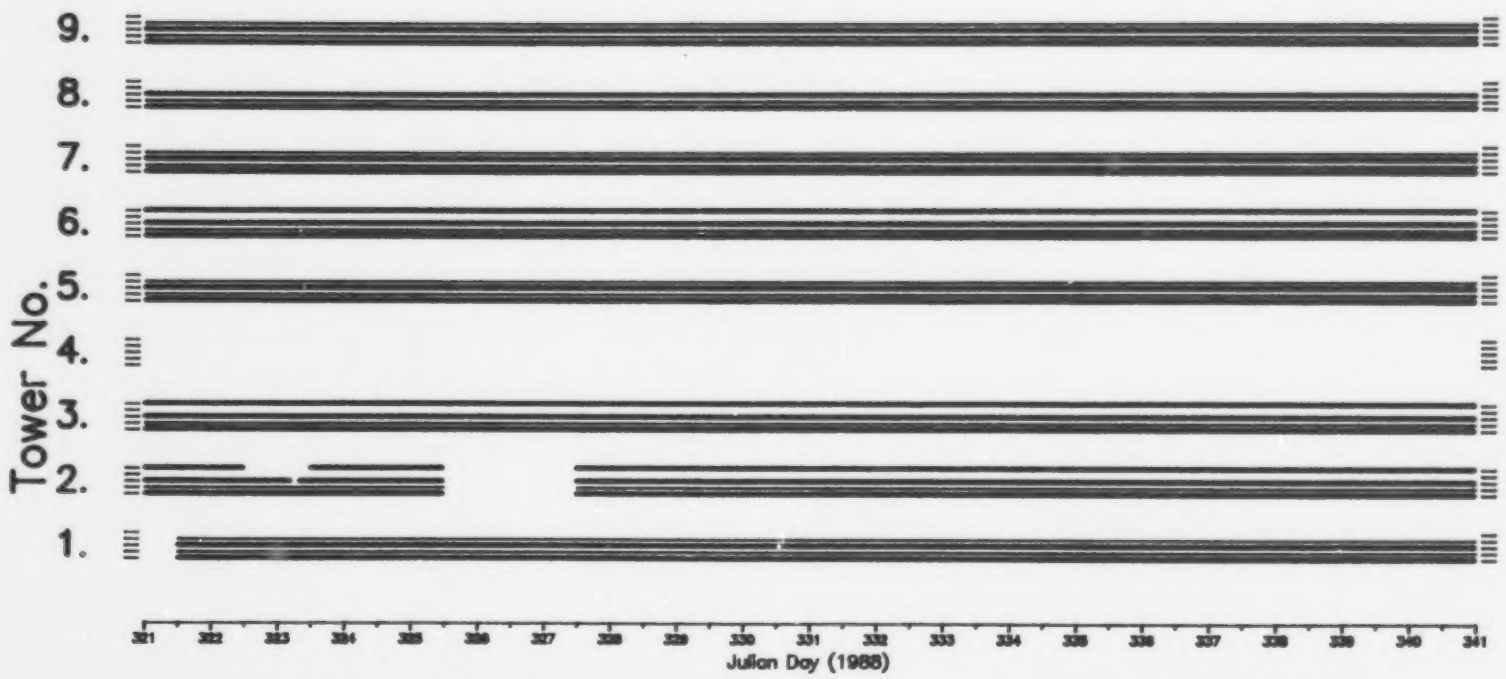
Pickering NGS 87/88/89 Met. Study – PAQMOS

Data availability



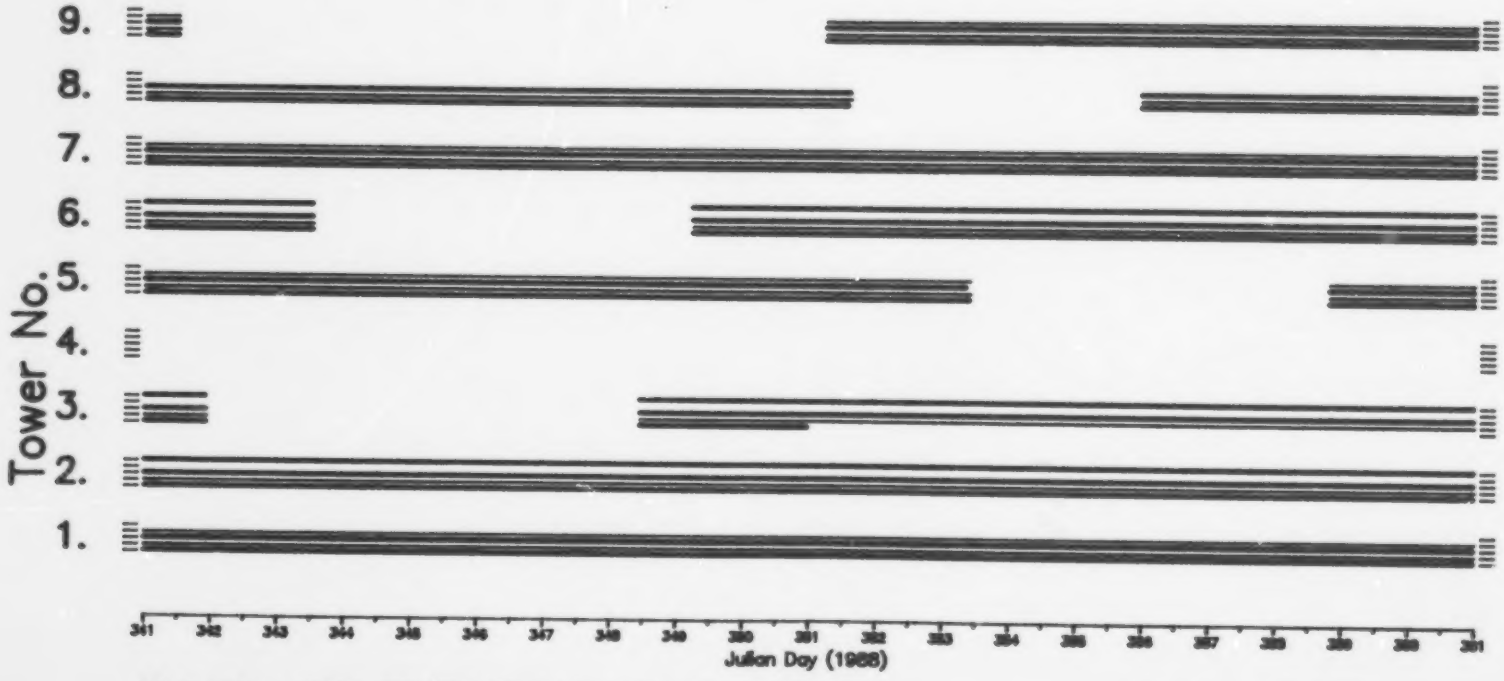
Pickering NGS 87/88/89 Met. Study – PAQMOS

Data availability



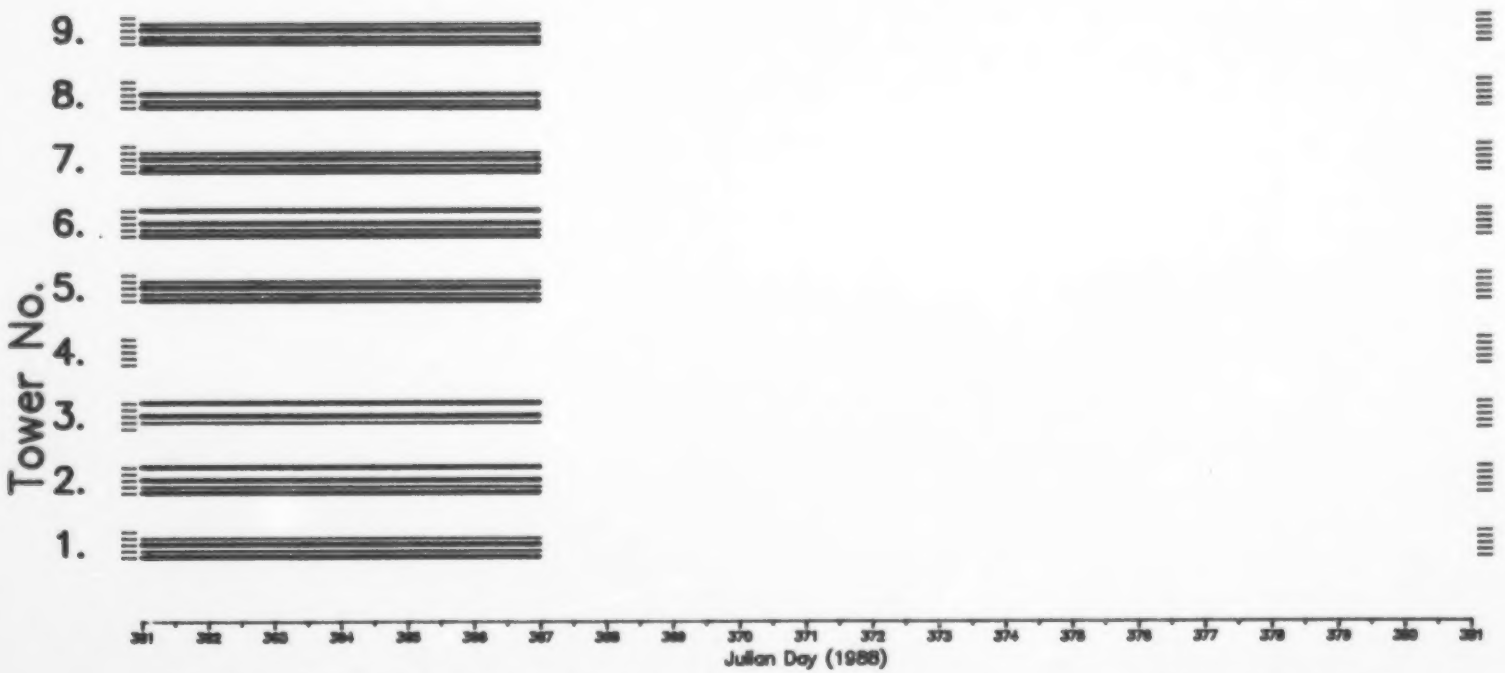
Pickering NGS 87/88/89 Met. Study – PAQMOS

Data availability



Pickering NGS 87/88/89 Met. Study – PAQMOS

Data availability



Pickering NGS 87/88/89 Met. Study – PAQMOS

Data availability

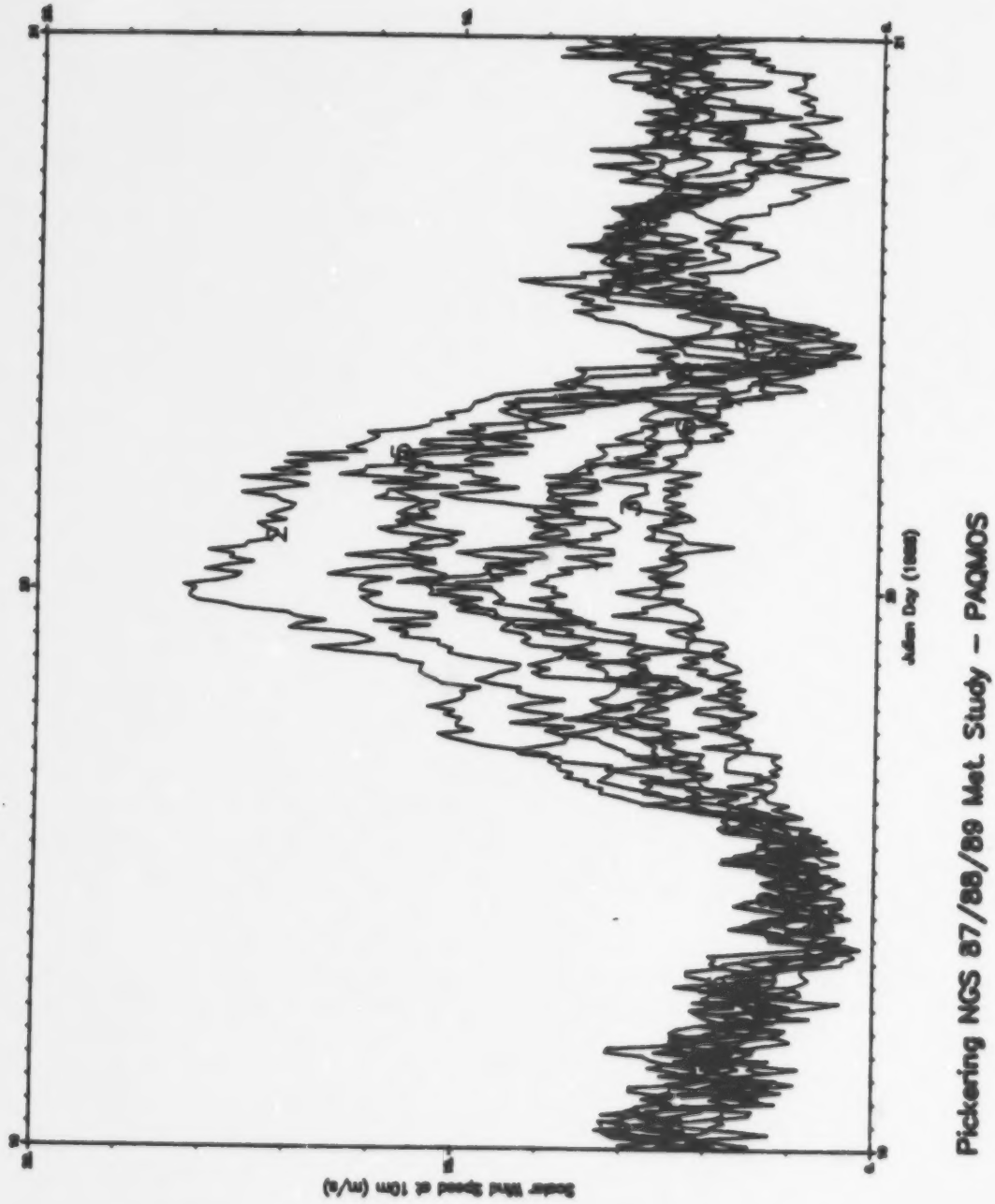


Figure 14. Scalar wind speed data from 9 stations for the period JD019-021.

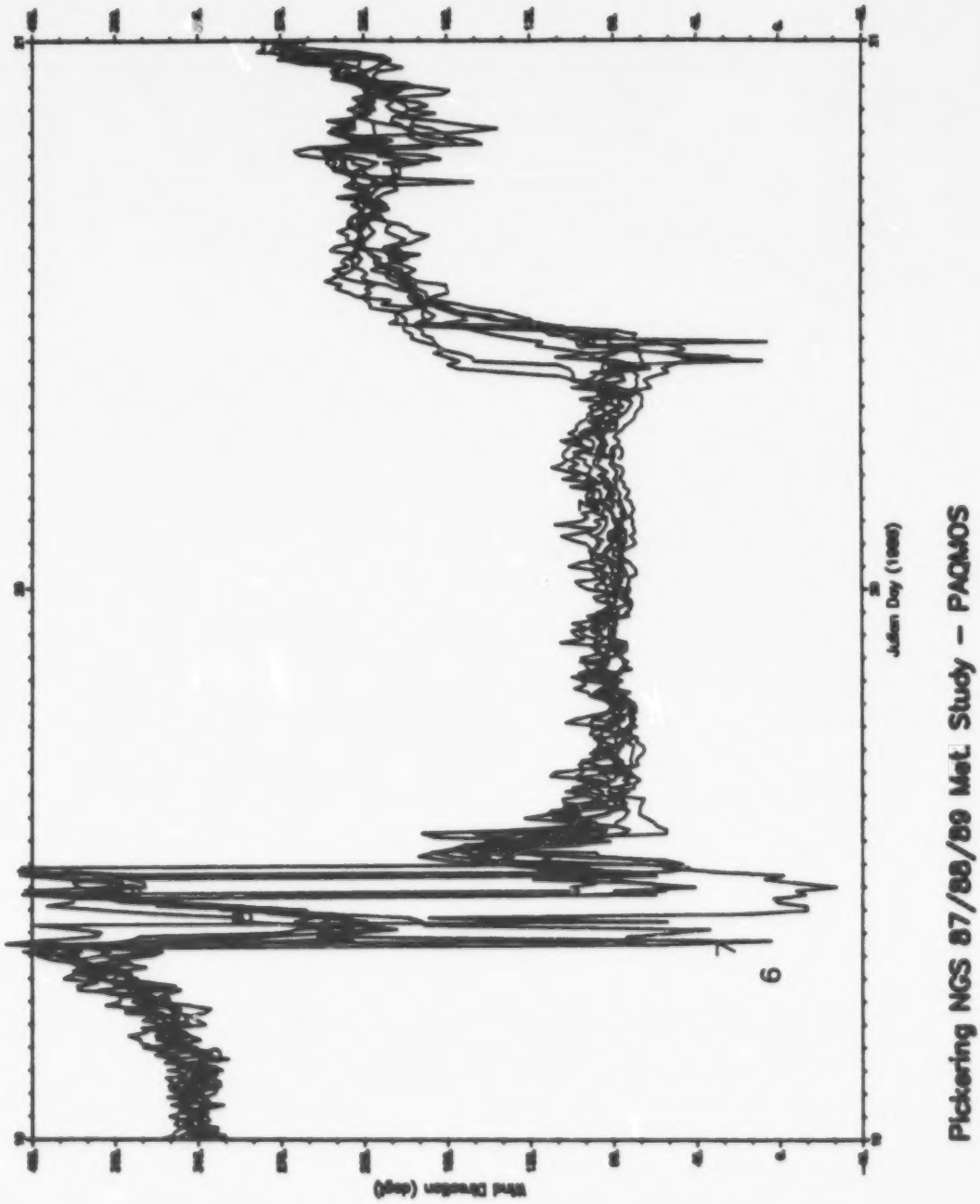


Figure 15. Wind direction data from 9 stations for the period JD019-021.

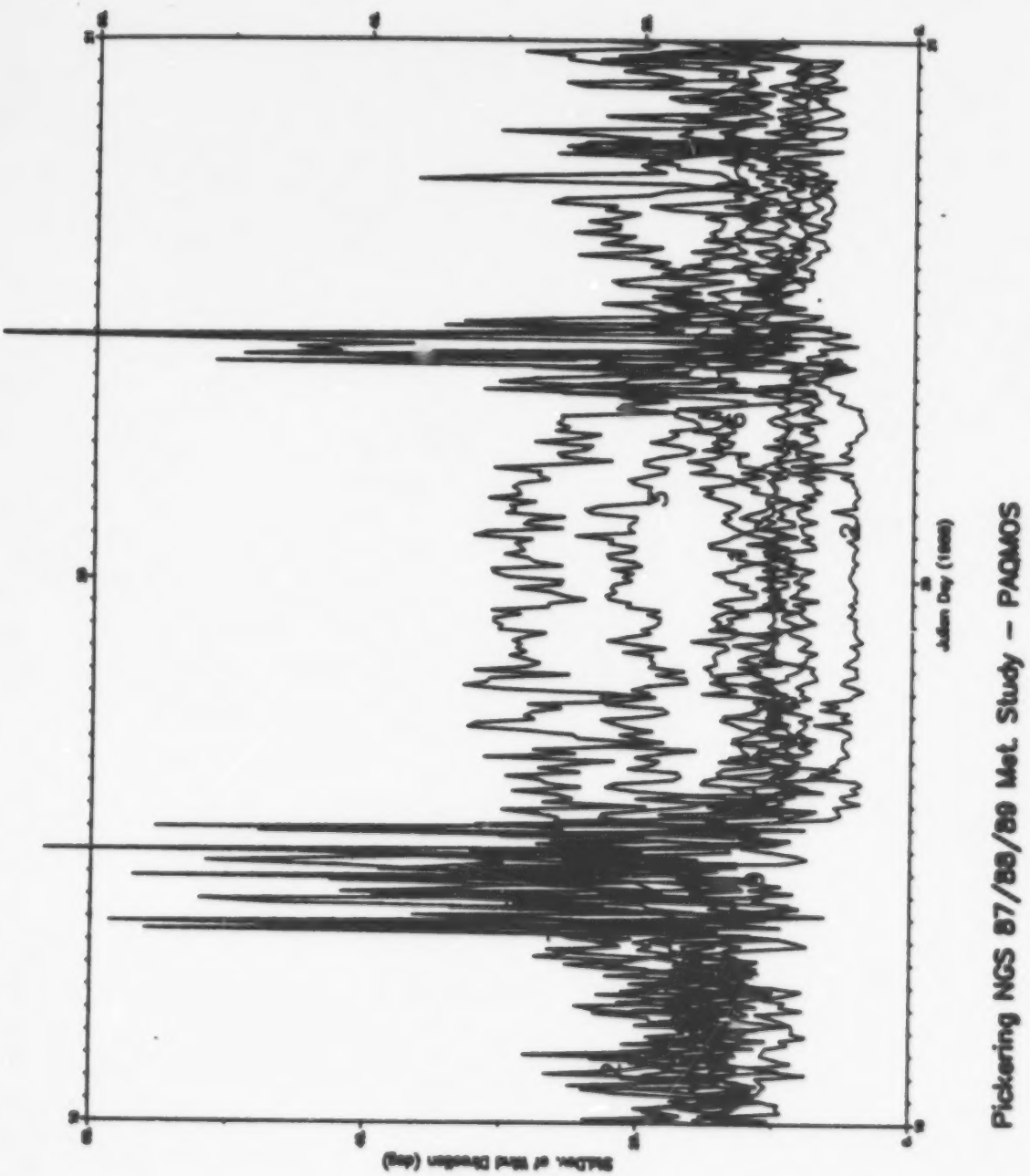


Figure 16. Wind direction standard deviation data from 9 stations for the period JD019-021.

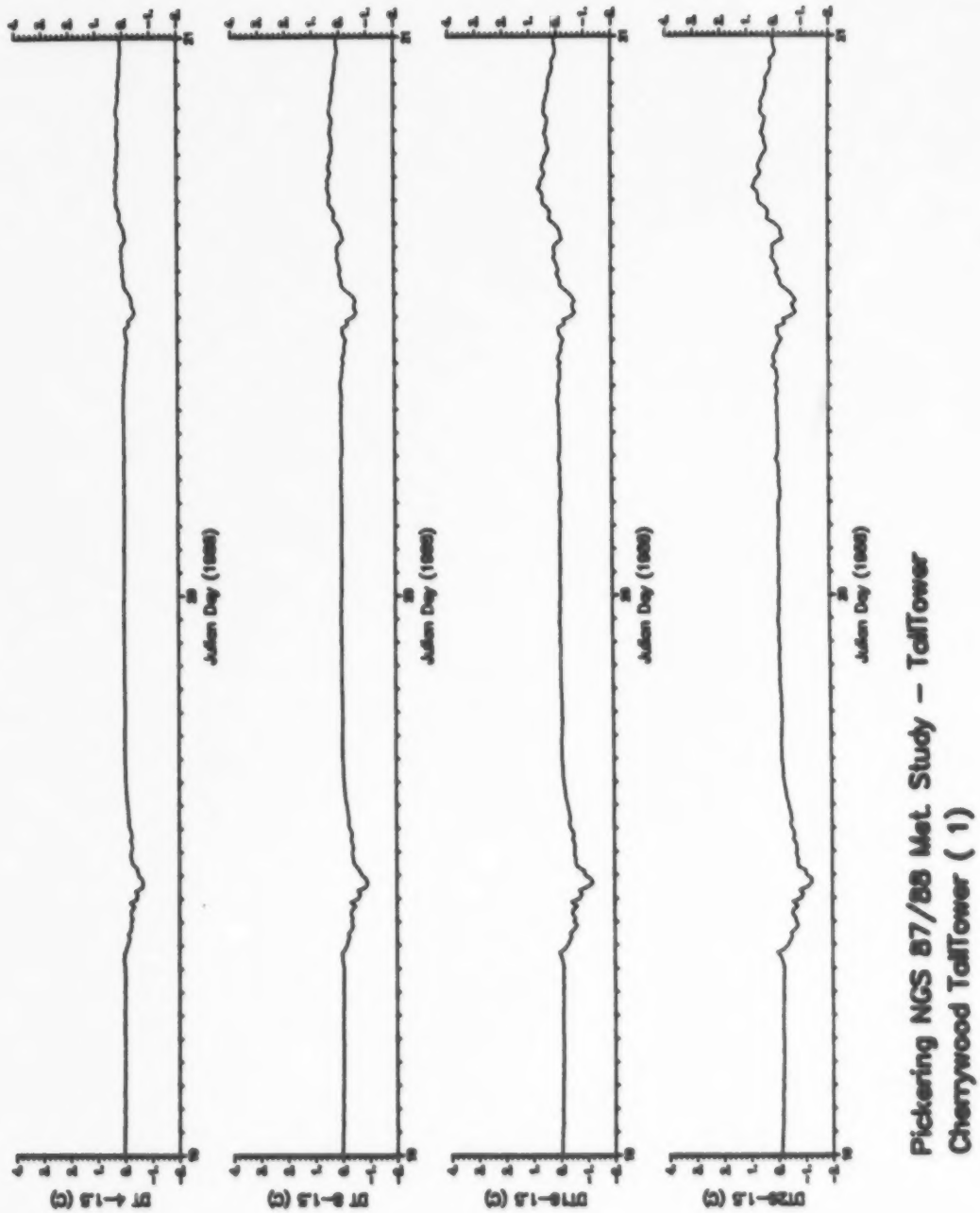


Figure 17. Temperature difference data from the Cherrywood 26m tower for the period JD019-021.

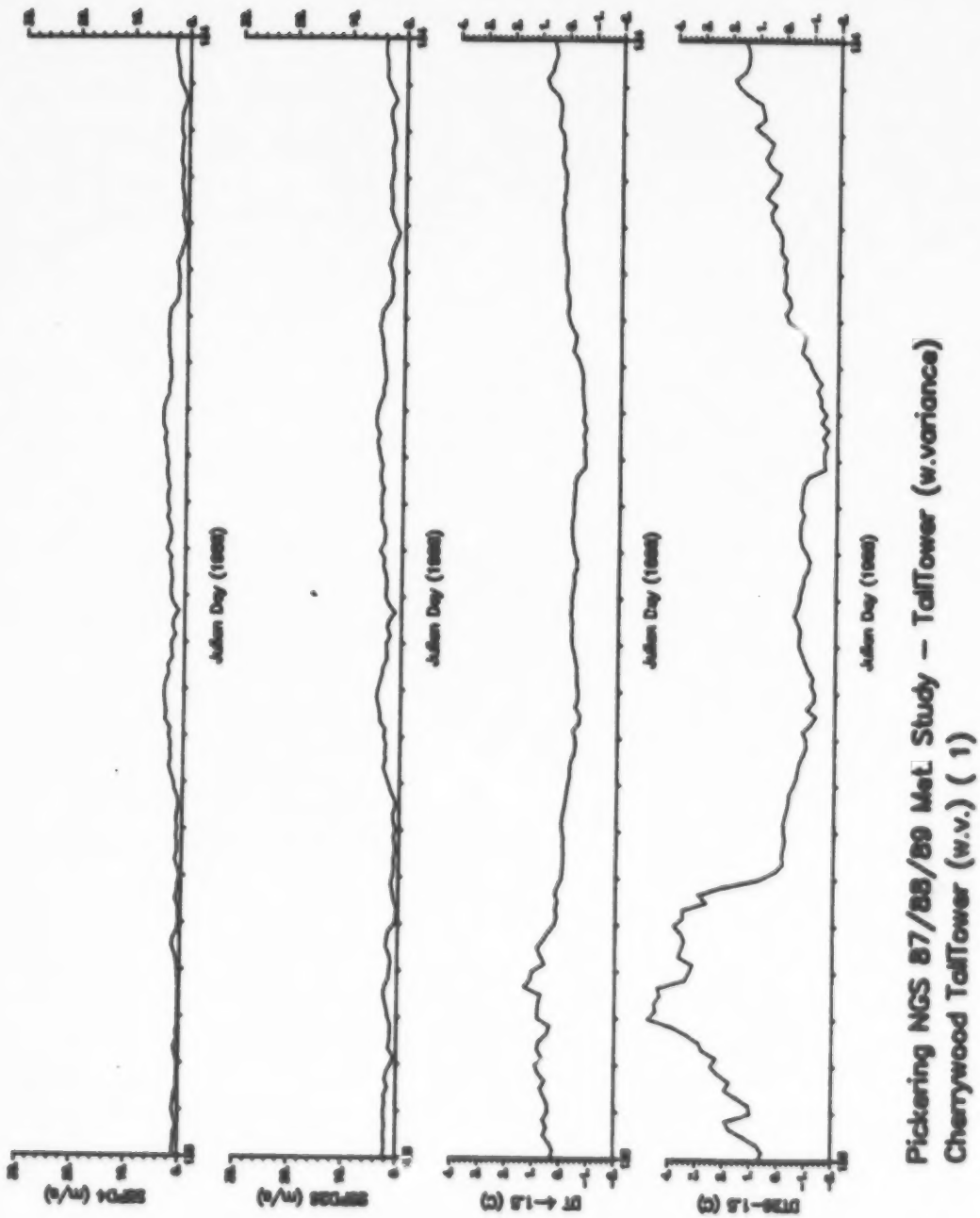

Pickering NGS 87/88/89 Met Study — TallTower (w.variance)
Cherrywood TallTower (w.v.) (1)
Julian Day (1988)
Julian Day (1988)
Julian Day (1988)
Julian Day (1988)

Figure 18. Wind speed and temperature difference data from the Cherrywood 26m tower for JD133.

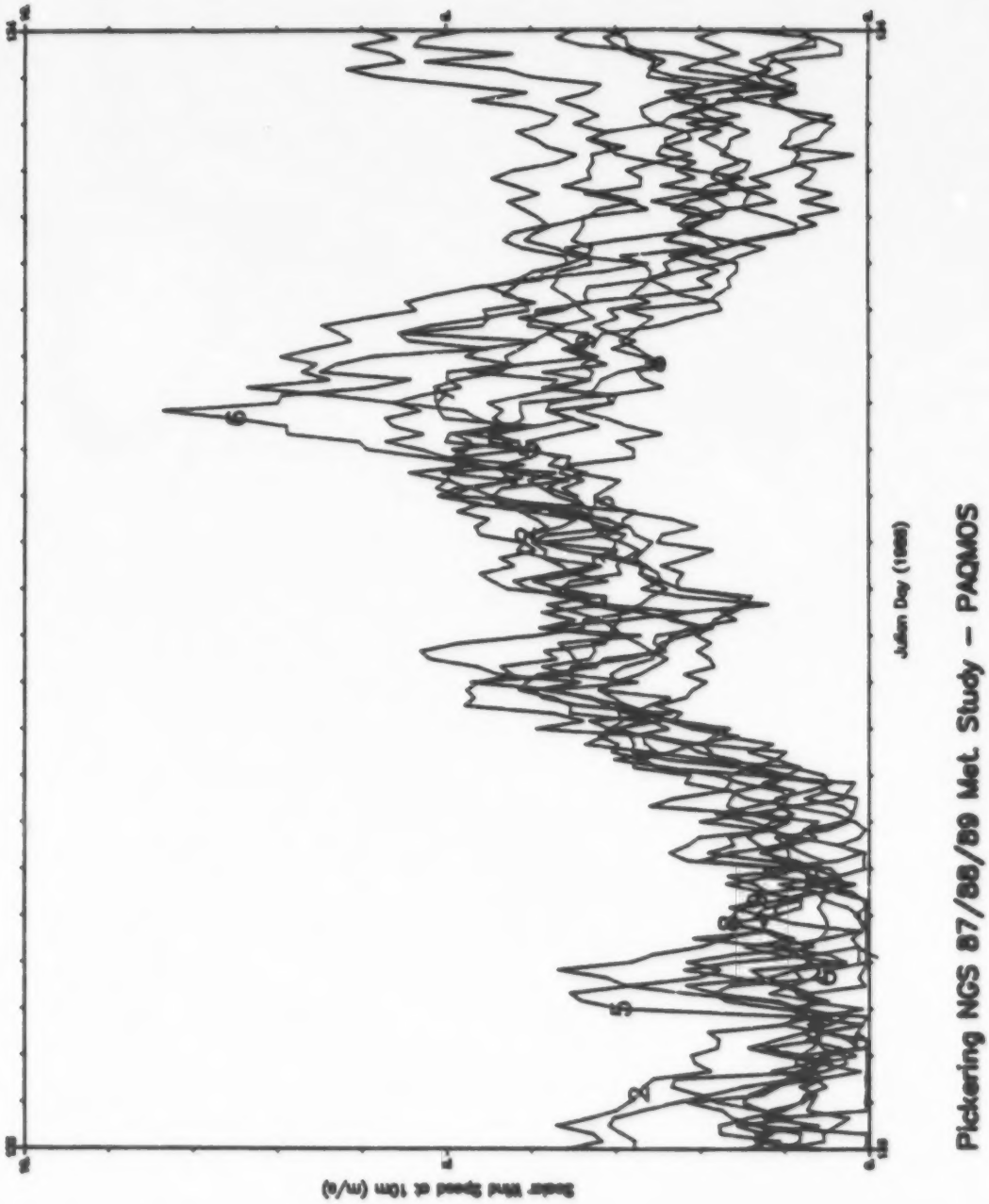


Figure 19. Scalar wind speed data from 9 stations for JD133.

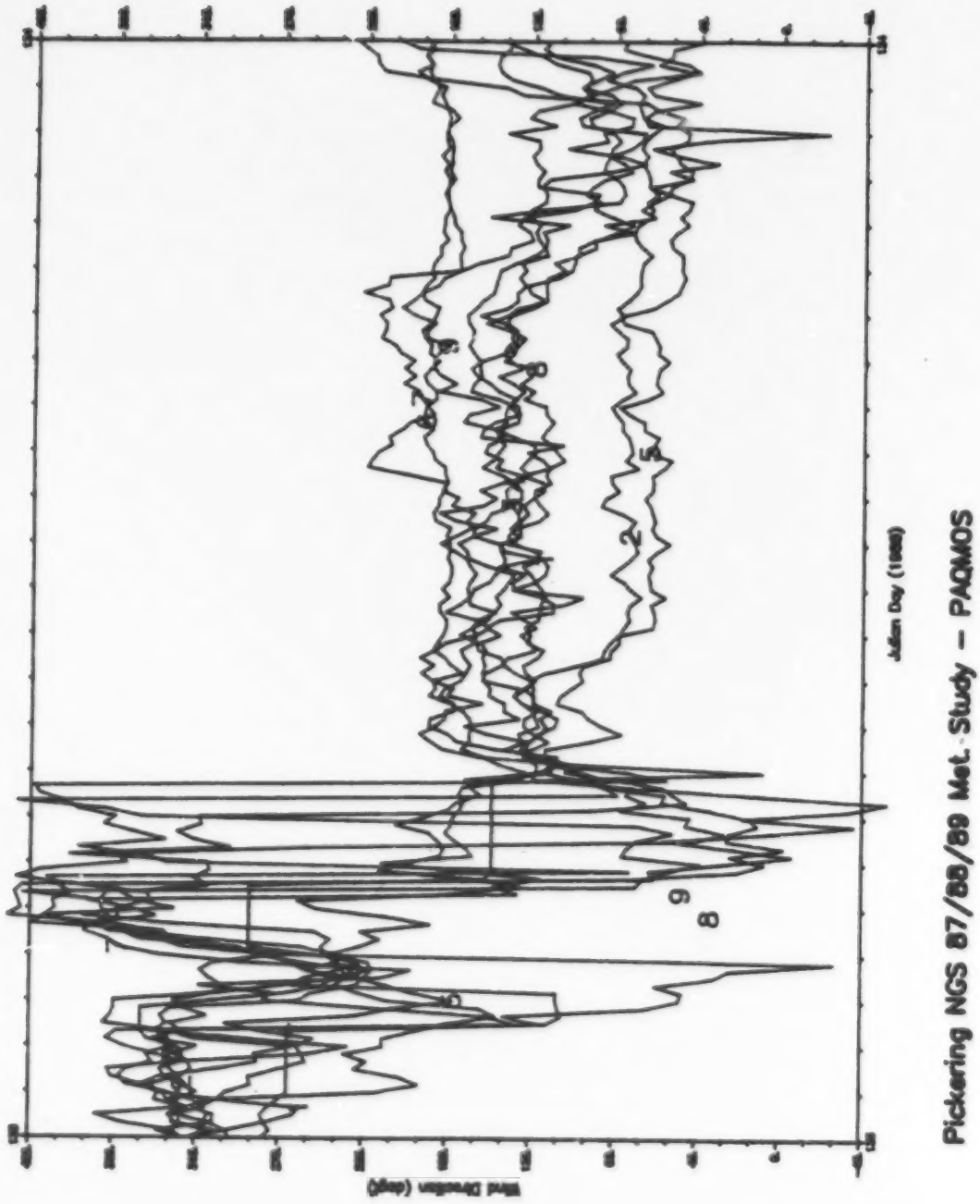
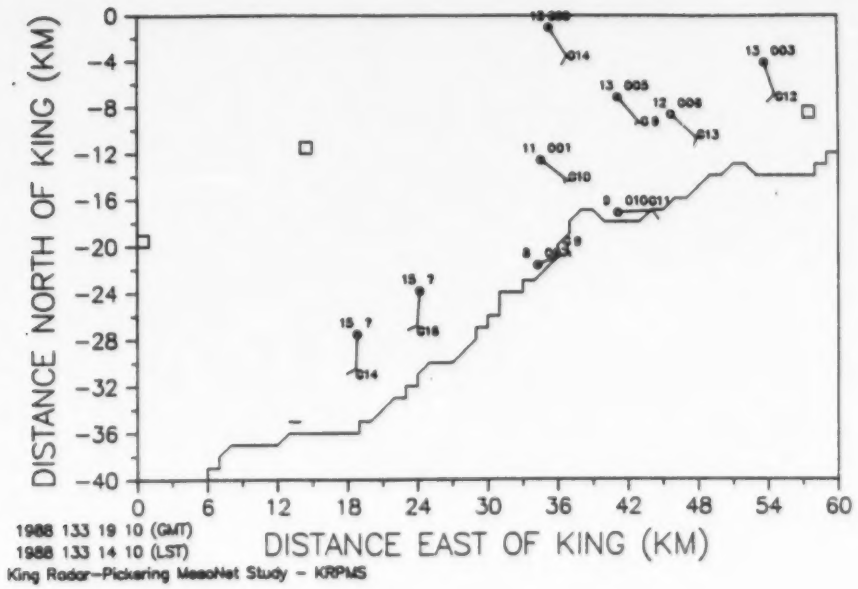


Figure 20. Wind direction data from 9 stations for JD133.



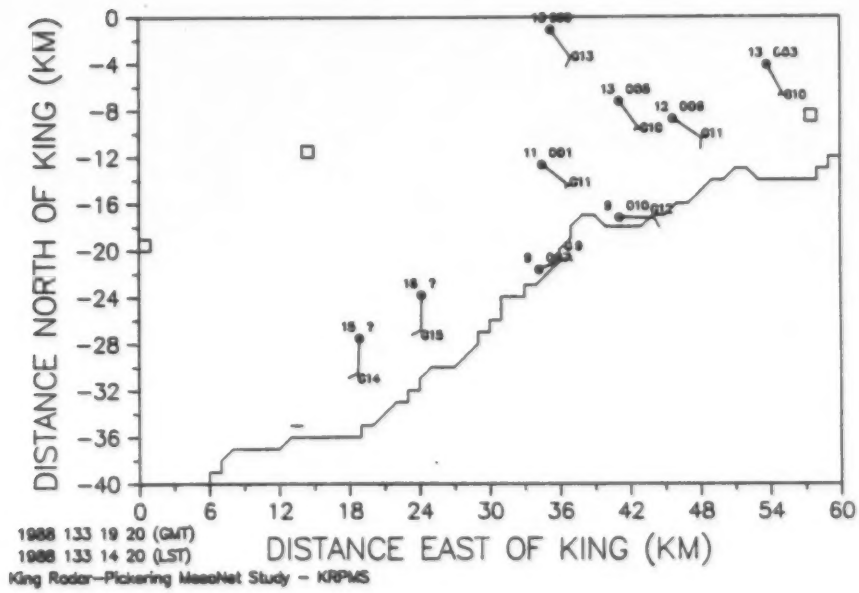


Figure 21. Vector wind plots for three 10min periods starting at 1400EST on JD133. Note that the times given on the plots are the end times of the 10min averaging periods. One full barb is equivalent to 10knots (5ms^{-1}). The numbers around the vector arrows are temperature (C), pressure (mb, modulo 1000) and maximum 1s gust (G14, *etc.*) in knots. The dashed line on the third plot is a subjectively drawn trajectory. Note that 'knots' is standard usage.

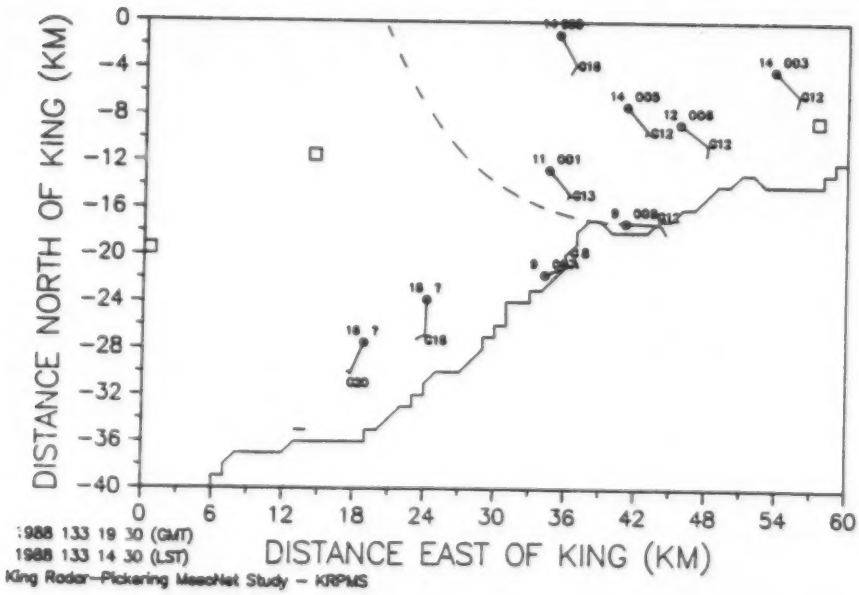


Figure 21. Continued.

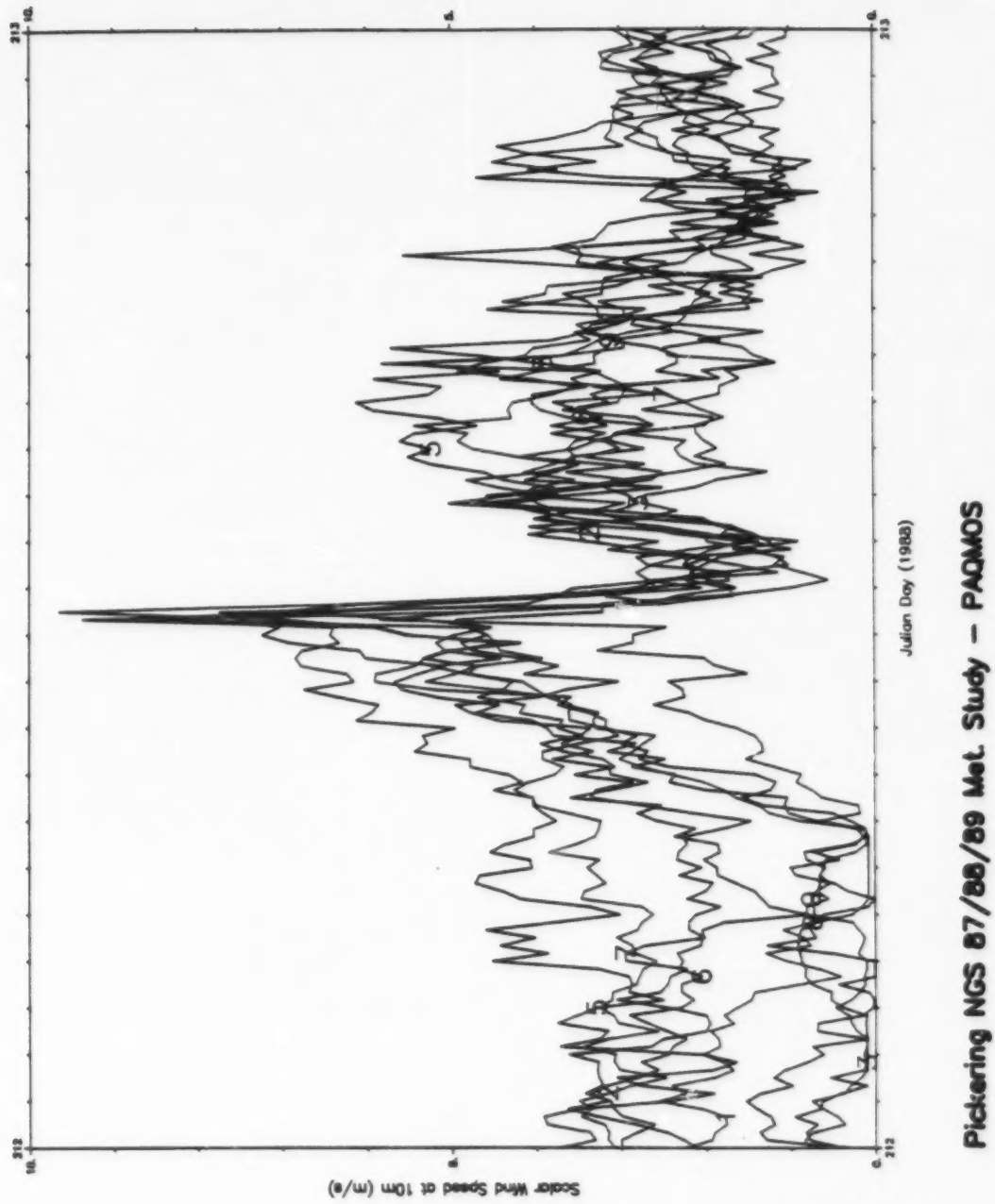


Figure 22. Scalar wind speed data from 8 stations for JD212.

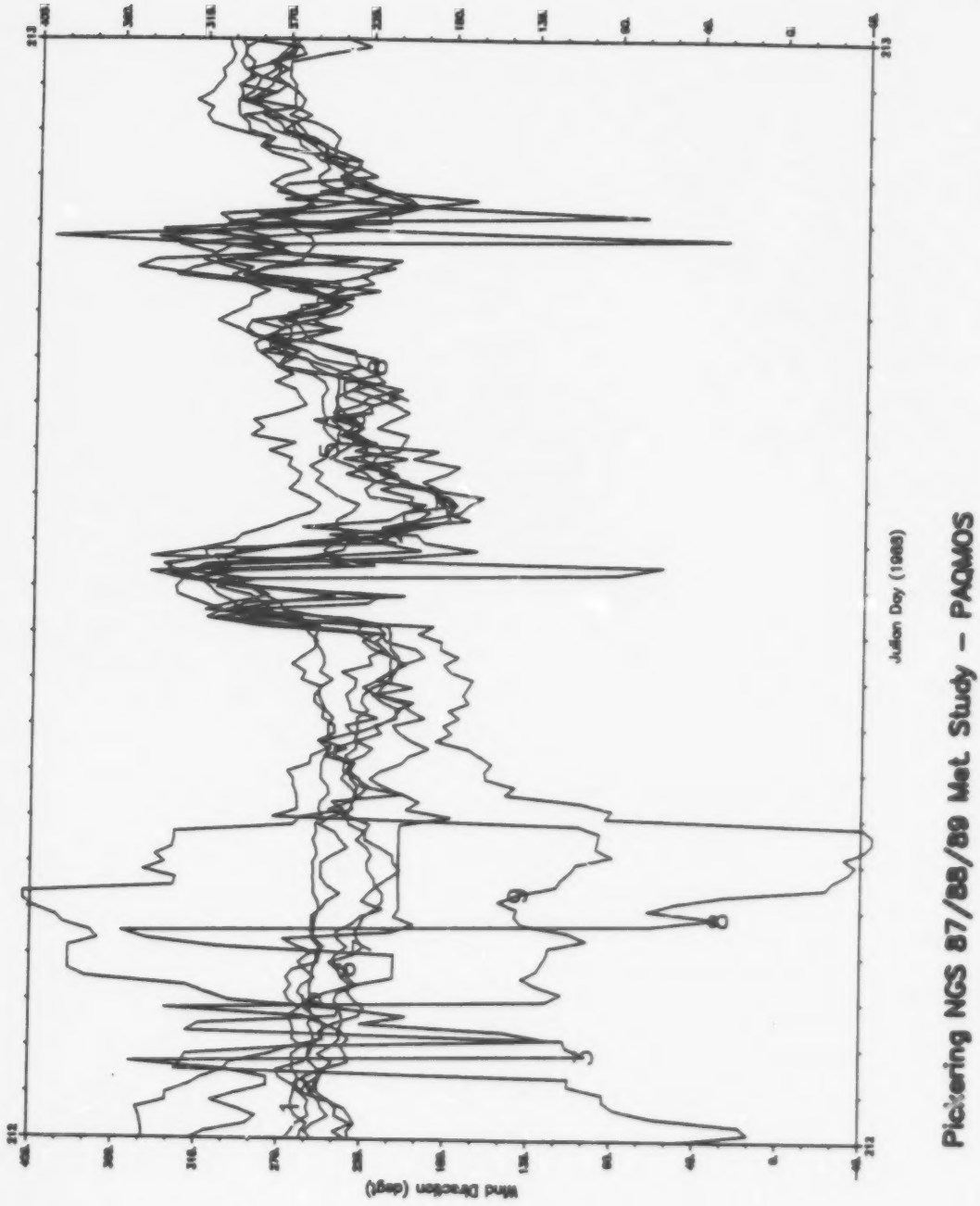
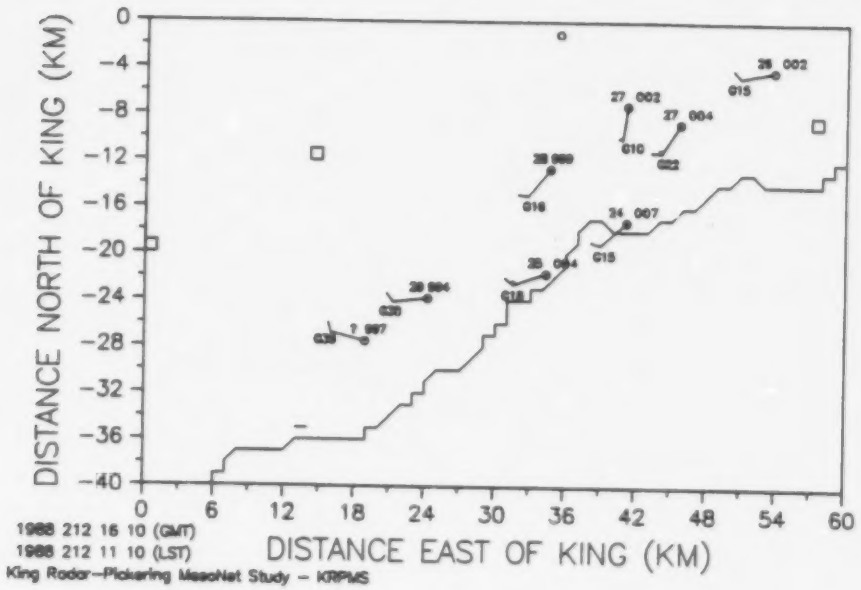


Figure 23. Wind direction data from 8 stations for JD212.



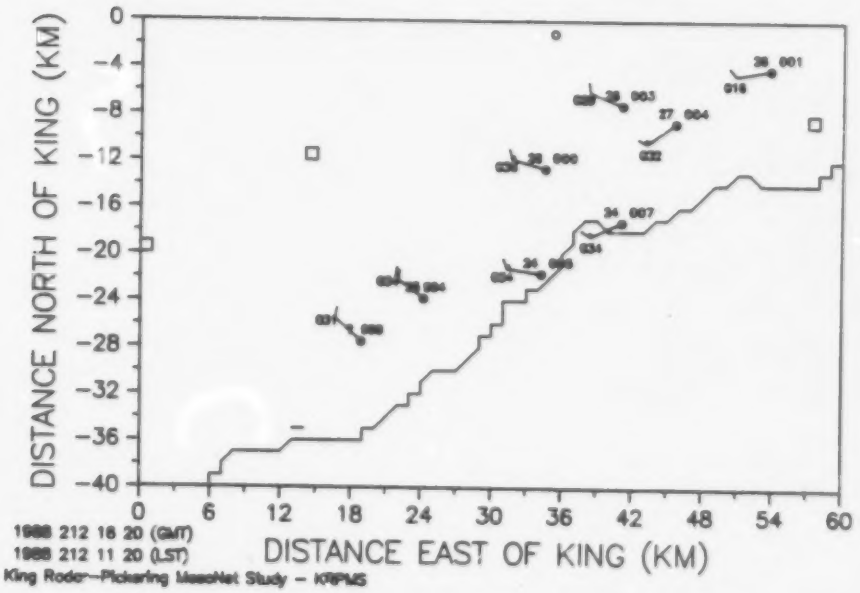
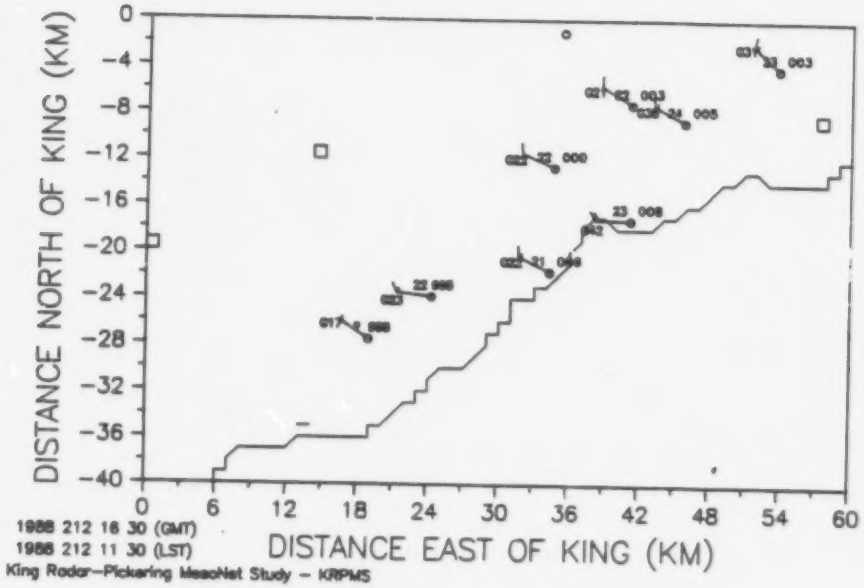


Figure 24. Vector wind plots for six 10min periods starting at 1100EST on JD212. Note that the times given on the plots are the end times of the 10min averaging periods. The format is the same as that of Figure 21.



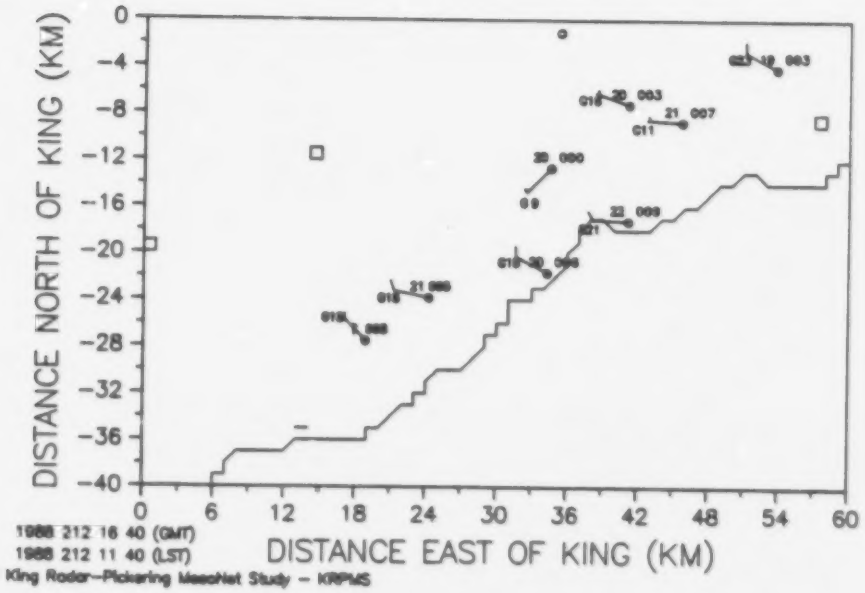
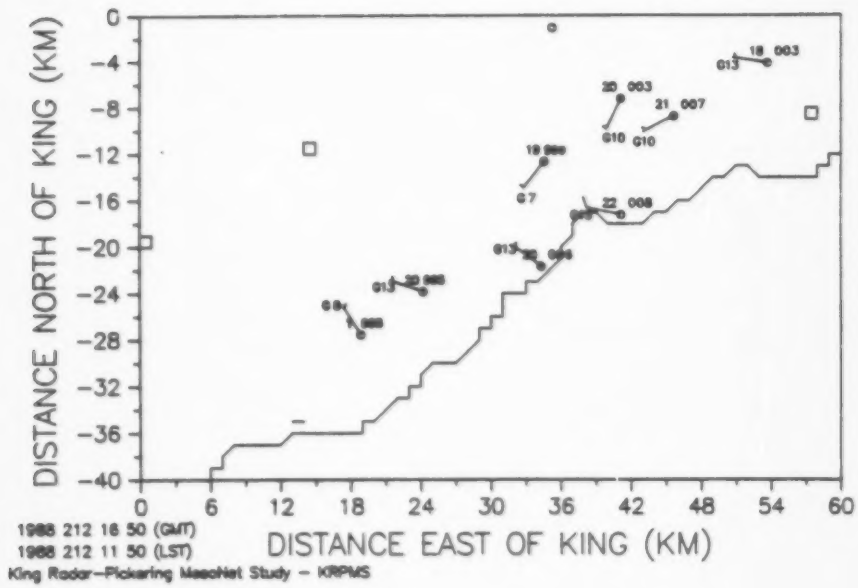


Figure 24. Continued.



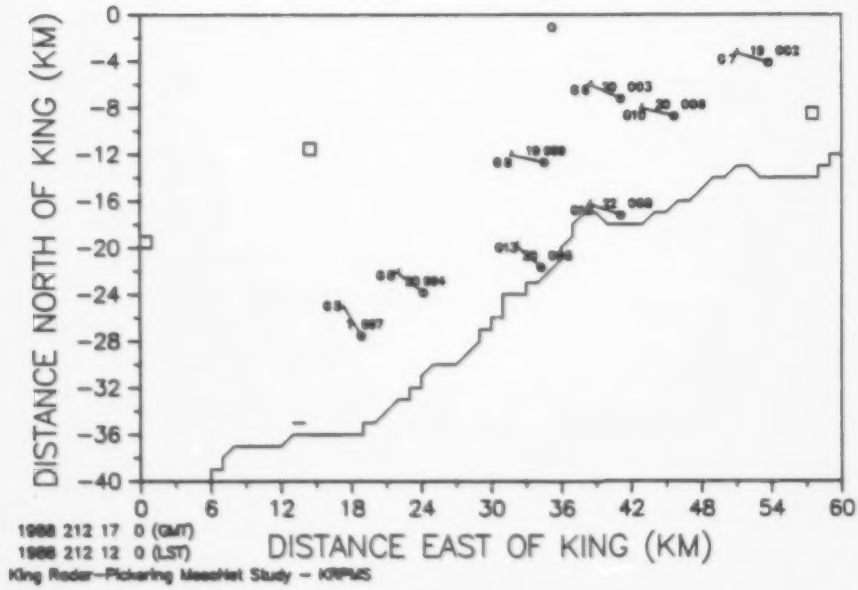


Figure 24. Continued.

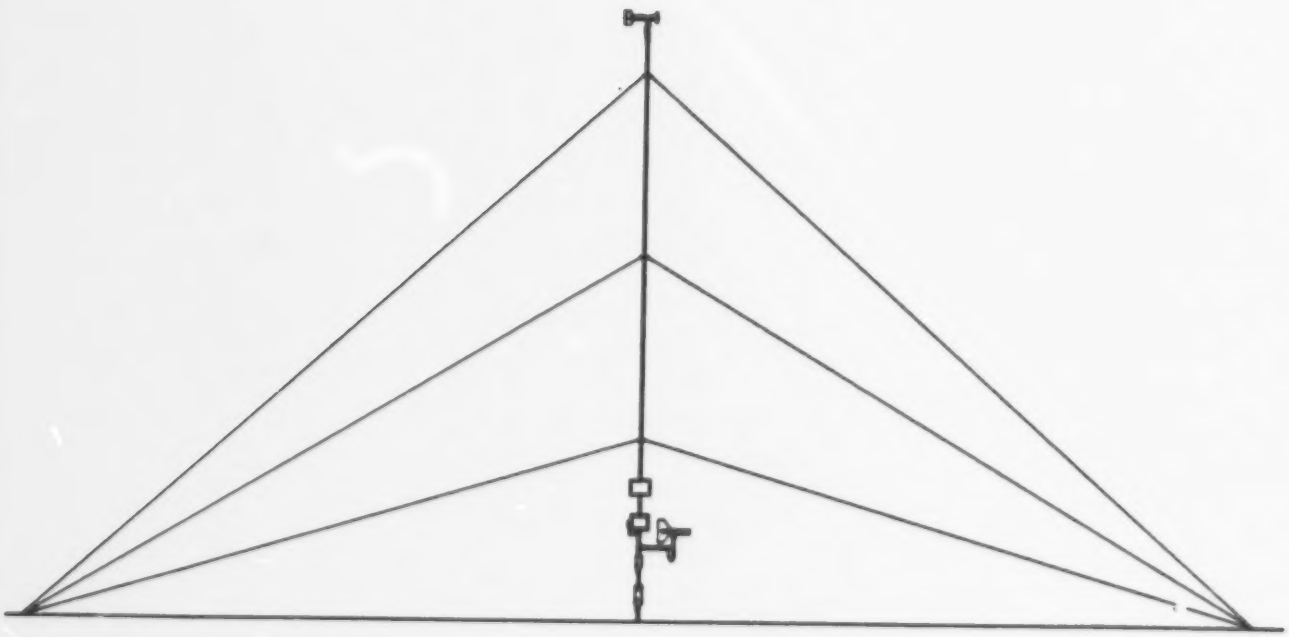


Figure A.1a. PAQMOS-10m post - full view.

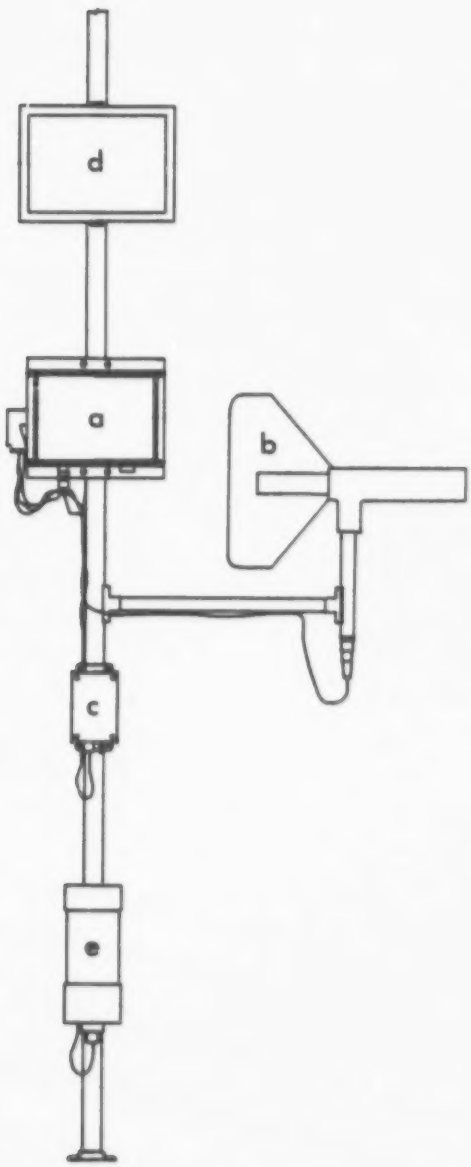


Figure A.1b. PAQMOS-10m post - view showing datalogger in enclosure (a), T/H sensor in radiation shield (b), barometer (c), solar panel (d) and auxiliary battery (e).

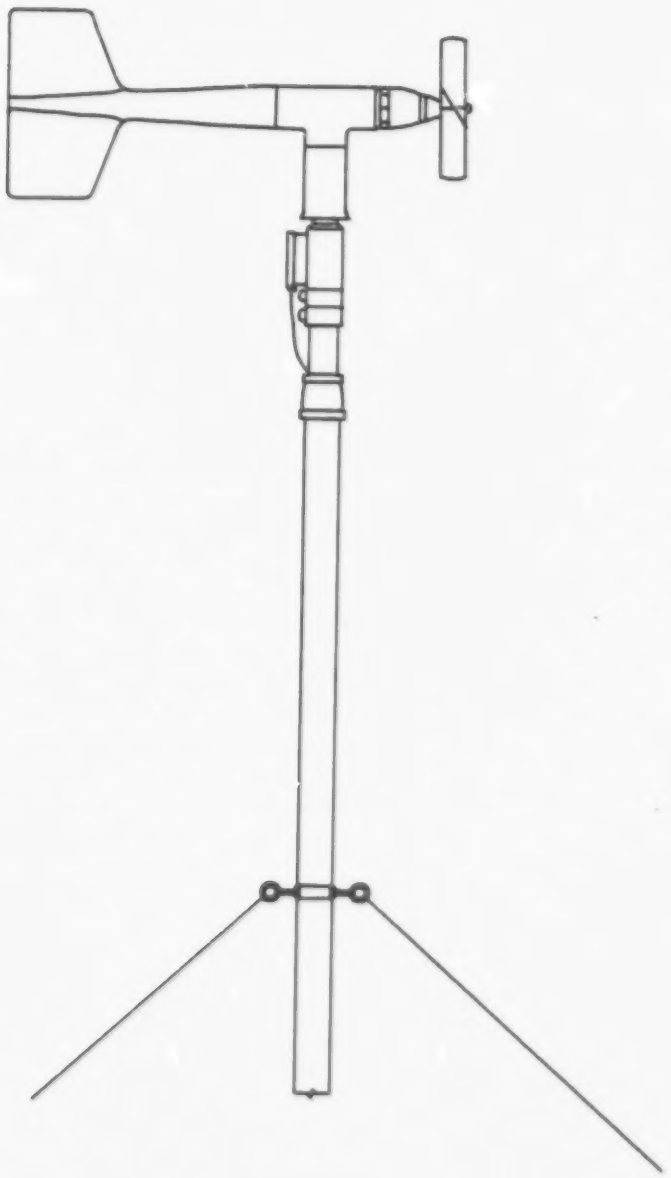


Figure A.1c. PAQMOS-10m post - view showing anemometer.

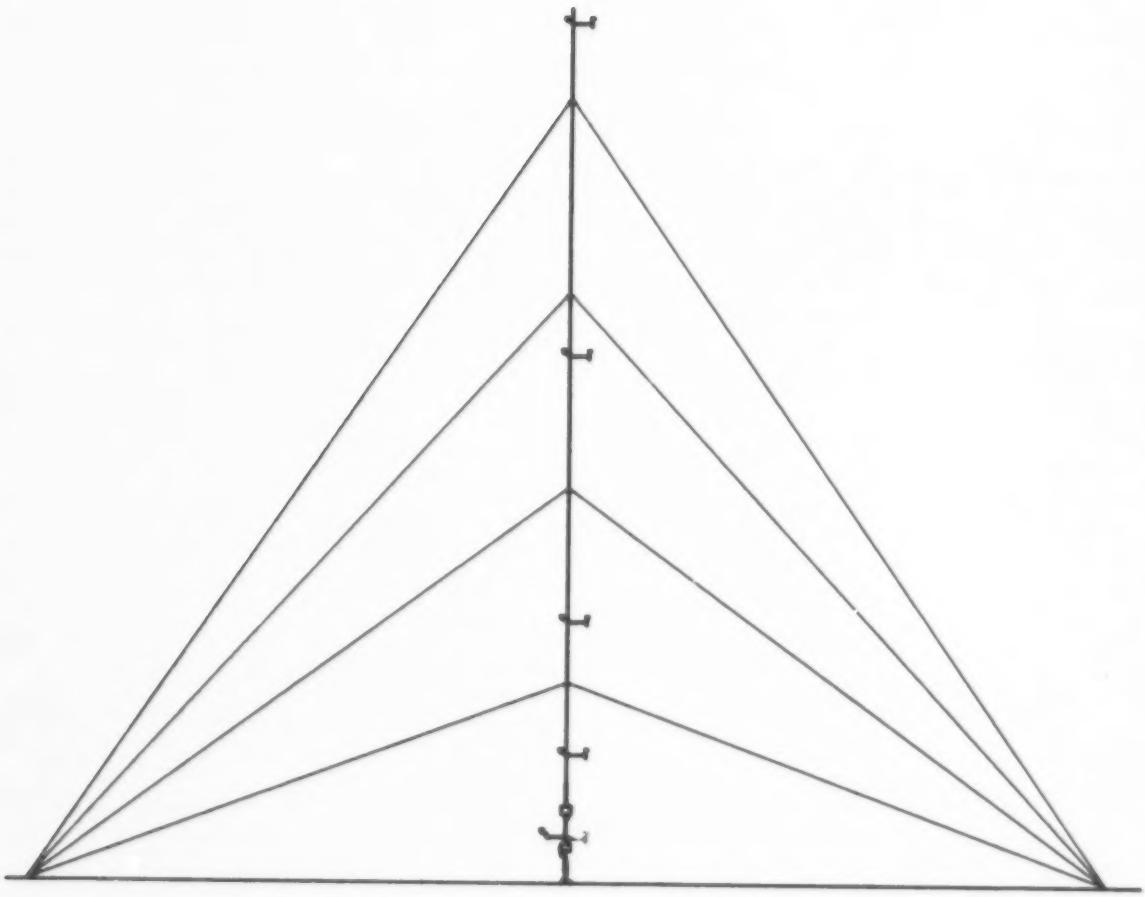


Figure B.1a. PAQMOS-26m - full view.

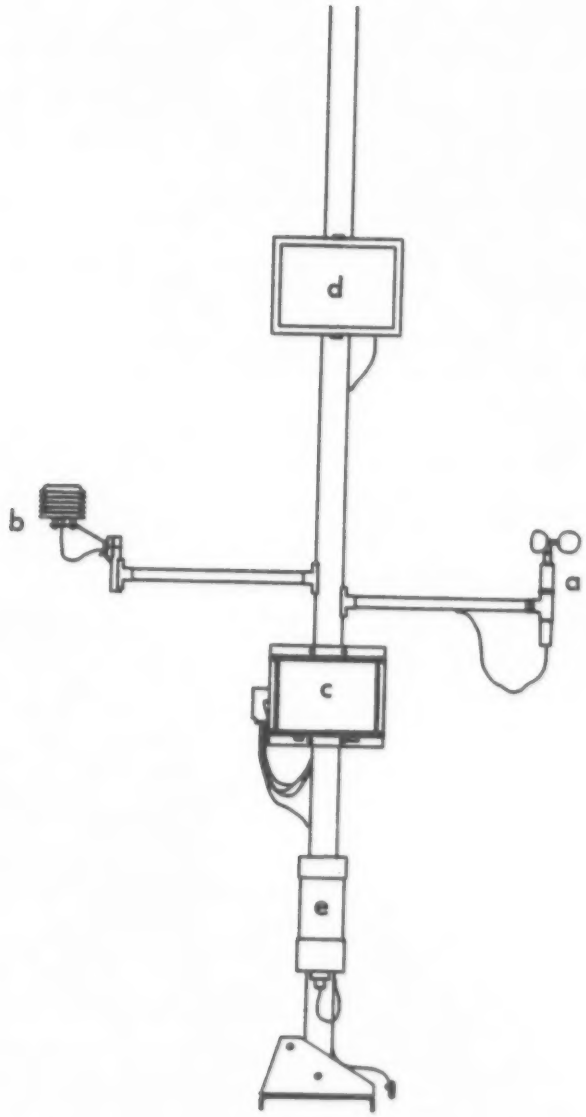


Figure B.1b. PAQMOS-26m - view showing anemometer (a), thermocouple in radiation shield (b), datalogger in enclosure (c), solar panel (d) and auxiliary battery (e).